ALASKA POLLUTANT DISCHARGE ELIMINATION SYSTEM

PERMIT FACT SHEET – DRAFT

Permit Number: AK0021377

Kenai Wastewater Treatment Facility

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Wastewater Discharge Authorization Program
555 Cordova Street
Anchorage, AK 99501

Public Comment Period Start Date: March 4, 2021
Public Comment Period Expiration Date: April 5, 2021
Alaska Online Public Notice System

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Proposed issuance of an Alaska Pollutant Discharge Elimination System (APDES) permit to

CITY OF KENAI

For wastewater discharges from

City of Kenai Wastewater Treatment Facility
800 South Spruce Street
Kenai, AK, 99611

The Alaska Department of Environmental Conservation (the Department or DEC) proposes to reissue an APDES individual permit (permit) to the City of Kenai. The permit authorizes and sets conditions on the discharge of pollutants from this facility to waters of the United States. In order to ensure protection of water quality and human health, the permit places limits on the types and amounts of pollutants that can be discharged from the facility and outlines best management practices to which the facility must adhere.

This fact sheet explains the nature of potential discharges from the Kenai Wastewater Treatment Facility (WWTF) and the development of the permit including:

- information on public comment, public hearing, and appeal procedures
- a listing of proposed effluent limits and other conditions
- technical material supporting the conditions in the permit
- proposed monitoring requirements in the permit

Public Comment

Persons wishing to comment on or request a public hearing for the draft permit for this facility, may do so in writing by the expiration date of the public comment period.

Commenters are requested to submit a concise statement on the permit condition(s) and the relevant facts upon which the comments are based. Commenters are encouraged to cite specific permit requirements or conditions in their submittals.

A request for a public hearing must state the nature of the issues to be raised, as well as the requester's name, address, and telephone number. The Department will hold a public hearing whenever the Department finds, based on requests, a significant degree of public interest in a draft permit. The Department may also hold a public hearing if a hearing might clarify one or more issues involved in a permit decision or for other good reason, in the Department's discretion. A public hearing will be held at the closest practicable location to the site of the operation. If the Department holds a public hearing, the Director will appoint a designee to preside at the hearing. The public may also submit written testimony in lieu of or in addition to providing oral testimony at the hearing. A hearing will be tape recorded. If there is sufficient public interest in a hearing, the comment period will be extended to allow time to public notice the hearing. Details about the time and location of the hearing will be provided in a separate notice.

All comments and requests for public hearings must be in writing and should be submitted to the Department at the technical contact address, fax, or email identified above (see also the public comments section of the attached public notice). Mailed comments and requests must be postmarked on or before the expiration date of the public comment period.

After the close of the public comment period and after a public hearing, if applicable, the Department will review the comments received on the draft permit. The Department will respond to the comments received in a Response to Comments document that will be made available to the public. If no substantive comments are received, the tentative conditions in the draft permit will become the proposed final permit.

The proposed final permit will be made publicly available for a five-day applicant review. The applicant may waive this review period. After the close of the proposed final permit review period, the Department will make a final decision regarding permit issuance. A final permit will become effective 30 days after the Department's decision, in accordance with the state's appeals process at 18 Alaska Administrative Code (AAC) 15.185.

The Department will transmit the final permit, fact sheet (amended as appropriate), and the Response to Comments to anyone who provided comments during the public comment period or who requested to be notified of the Department's final decision.

Appeals Process

The Department has both an informal review process and a formal administrative appeal process for final APDES permit decisions. An informal review request must be delivered within 20 days after receiving the Department's decision to the Director of the Division of Water at the following address:

Director, Division of Water
Alaska Department of Environmental Conservation

555 Cordova Street
Anchorage AK, 99501

Interested persons can review 18 AAC 15.185 for the procedures and substantive requirements regarding a request for an informal Department review.

See http://dec.alaska.gov/commish/review-guidance/informal-reviews for information regarding informal reviews of Department decisions.

An adjudicatory hearing request must be delivered to the Commissioner of the Department within 30 days of the permit decision or a decision issued under the informal review process. An adjudicatory hearing will be conducted by an administrative law judge in the Office of Administrative Hearings within the Department of Administration. A written request for an adjudicatory hearing shall be delivered to the Commissioner at the following address:

Commissioner
Alaska Department of Environmental Conservation
Mail : P.O. Box 11180
Juneau, AK 99811
In Person: 555 Cordova Street
Anchorage, AK 99501

Interested persons can review 18 AAC 15.200 for the procedures and substantive requirements regarding a request for an adjudicatory hearing. See http://dec.alaska.gov/commish/review-guidance/adjudicatory-hearing-guidance for information regarding appeals of Department decisions.

Documents are Available

The permit, fact sheet, application, and related documents can be obtained by visiting or contacting DEC between 8:00 a.m. and 4:30 p.m. Monday through Friday at the addresses below. The permit, fact sheet, application, and other information are located on the Department's Wastewater Discharge Authorization Program website: http://dec.alaska.gov/water/wastewater/.

Alaska Department of Environmental Conservation Division of Water Wastewater Discharge Authorization Program 555 Cordova Street Anchorage, AK 99501 (907) 269-6285	Alaska Department of Environmental Conservation Division of Water Wastewater Discharge Authorization Program 410 Willoughby Avenue, Suite 303 Juneau, AK 99811-1800 (907) 465-5180

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1.0 INTRODUCTION

1.1 Applicant

This fact sheet provides information on the Alaska Pollutant Discharge Elimination System (APDES) permit for the following entity:

Permittee:	City of Kenai
Facility:	Kenai Wastewater Treatment Facility
APDES Permit Number:	AK0021377
Facility Location:	600 South Spruce Street Kenai AK 99611
Mailing Address:	210 Fidalgo Avenue, Kenai, AK 99611
Facility Contact:	Mr. Scott Curtin

The map in Figure 1, Part 2.1 shows the locations of the treatment plant and the outfall. The process flow diagram in Part 2.2, Figure 2, illustrates the treatment process.

1.2 Authority

Section 301(a) of the Clean Water Act (CWA) and Alaska Administrative Code (AAC) 18 AAC 83.015 provide that the discharge of pollutants to water of the U.S. is unlawful except in accordance with an APDES permit. The individual permit reissuance is being developed per 18 AAC 83. A violation of a condition contained in the Permit constitutes a violation of the CWA and subjects the permittee of the facility with the permitted discharge to the penalties specified in Alaska Statutes (AS) 46.03.760 and AS 46.03.761.

1.3 Permit History

The original sewerage system for the City of Kenai (City)was an extended aeration plant design with rapid sand filtration that began construction in 1964 and was completed by 1970. In 1978, CH2M Hill was contracted by the City to design the activated sludge plant as it exists in its present form. Construction of the main plant was completed in 1981 and the last major addition was the Chlorine Building, built in the mid- 1990s. The Kenai Wastewater Treatment Facility (Kenai WWTF, or facility) treats domestic wastewater from the City. In the treatment process, influent enters the facility through a manhole and receives preliminary treatment to pulverize solids. After preliminary treatment, the wastewater is distributed to four aeration basins and then the flow is directed to two secondary clarifiers where it is chlorinated for disinfection and subsequently dechlorinated. Treated effluent flows out of the facility through a 1700-foot (ft) outfall pipe where it discharges to Cook Inlet, a marine water body.

The City was first issued a National Pollutant Discharge Elimination System (NPDES) permit by the Environmental Protection Agency (EPA) for the discharge of treated wastewater from Kenai WWTF in 1973 and has continued to be permitted to discharge treated wastewater. The most recent EPA-issued permit was issued on September 1, 2008 and expired on August 31, 2013. On June 30, 2015, the Alaska Department of Environmental Conservation (the Department or DEC) issued the first Alaska Pollutant Discharge Elimination System (APDES) permit to the City for the Kenai WWTF. An application for a new permit was submitted by the City on June 5, 2020. The Department administratively extended the permit on July 14, 2020.

2.0 BACKGROUND

2.1 Facility Information

The City owns, operates and maintains a publicly owned treatment works (POTW) located in Kenai, Alaska. The Kenai WWTF is a complete mix modification of an activated sludge secondary treatment facility, treating domestic wastewater from the community of 7,100; however, the City is a tourist area and the actual population

is higher during summer months. The facility receives no significant industrial discharge, and the system has no combined sewers. The design flow rate for the facility is 1.3 million gallons per day (mgd), with a maximum daily limit of 1.44 mgd. Influent is subjected to preliminary treatment to remove solids and is directed then to an aeration basin. Following aeration, the flow receives treatment in a secondary clarifier. The treated effluent is disinfected with chlorine before it is discharged through a 12-inch outfall pipe that runs from the facility to mean high water and continues for 1300 feet (ft) into Cook Inlet in a direction perpendicular to the shoreline. Due to the shallowness of the water body's receiving area, the outfall at the end of the effluent line is exposed for three or four hours per day during negative low tide cycles.

Since the previous APDES permit issuance, major modifications to the facility include: an aeration basin blower replacement and an additional dissolved oxygen (DO) analyzer installed in November 2019. A Waste Activated Sludge (WAS) Pump replacement was installed in 2020. More information about recent upgrades to the Kenai WWTF can be found in Fact Sheet Part 3.3. Figure 1 shows a map of the location of the Kenai WWTF and Figure 2 is a schematic of the facility's process flow system.

Figure 1: Kenai Wastewater Treatment Facility Vicinity Map

2.2 Wastewater Treatment

The facility was designed and constructed to provide secondary treatment of domestic wastewater using a complete mix modification of an activated sludge secondary treatment prior to final discharge to the marine water of Cook Inlet. Influent flows into the facility from a manhole located on the east side of the property. Influent containing solids larger than 0.3 inches is directed to a microscreen sewage grinder to screen out large waste particles for disposal and directs the liquid influent on for further treatment. Following preliminary treatment, wastewater is distributed to four aeration basins through a splitter box. Of the four aeration basins, only three are generally in operation at one time. Each basin holds 130,000 gallons and are equipped with coarse diffusers to generate a complete mix. Following the aeration process, a second splitter box directs the flow to two secondary clarifiers, each with a capacity of 176,000 gallons, that are both in operation at all times. The clarifiers produce finished water and sludge. Sludge from the clarifiers is either fed through an Archimedes screw pump where is it routed back to the headworks as reactivated sludge (RAS), or fed through a Moyano pump as WAS where it is routed to the digester. Dewatered sludge is hauled to the Soldotna landfill. Finished water from the clarifiers enters a chlorination chamber where it is disinfected with a 12.5% sodium hypochlorite solution to secondary treatment standards. Chlorine contact time varies with flow, but typically lasts four hours. Following chlorination, the effluent is then dechlorinated, using a 38% sodium bisulfite solution. The effluent is only in contact with sodium bisulfite for a short time. The ratio of chlorination to dechlorination is 2:1. After dechlorination, the effluent passes through a Parshall plume before discharging into an outfall pipe thatextends approximately 400 ft to Mean Lower Low Water (MLLW) and for an additional 1300 ft for a total distance of 1700 ft, terminating in a single riser port discharge unit fitted with an orifice plate at a depth of approximately two feet below the surface except for three to four hours at low tide during negative tidal conditions when the riser port discharge unit is exposed above the water's surface.

Table 1 summarizes average facility performance based on daily maximum values reported through DMRs submitted to DEC and netDMR reports from August 2015 through July 2020.

Table 1: Design Criteria for the Kenai Wastewater Treatment Facility

Peak Design Maximum Daily Flow Rate	1.44 mgd
Design Flow Rate	1.3 mgd
Average Maximum Daily flow – 8/2015 – 7/2020	0.70 mgd
Peak Daily flow – 6/2015 – 5/2020	1.25 mgd
Average Monthly Flow Rate – 8/2015 – 7/2020	0.53 mgd
Average Maximum Daily Biological Oxygen Demand, 5-day (BOD_5) Load – 8/2015 – 7/2020	77 pounds per day (lbs/day)
Average Maximum Daily TSS Load: – 8/2015 – 7/2020	113.2 lbs/day
Average BOD_5 Percent Removal – 8/2015 – 7/2020	94.4 percent (%)
Average TSS Percent Removal– 8/2015 – 7/2020	95.1%

Figure 2: Kenai Wastewater Treatment Plant Process Flow Diagram

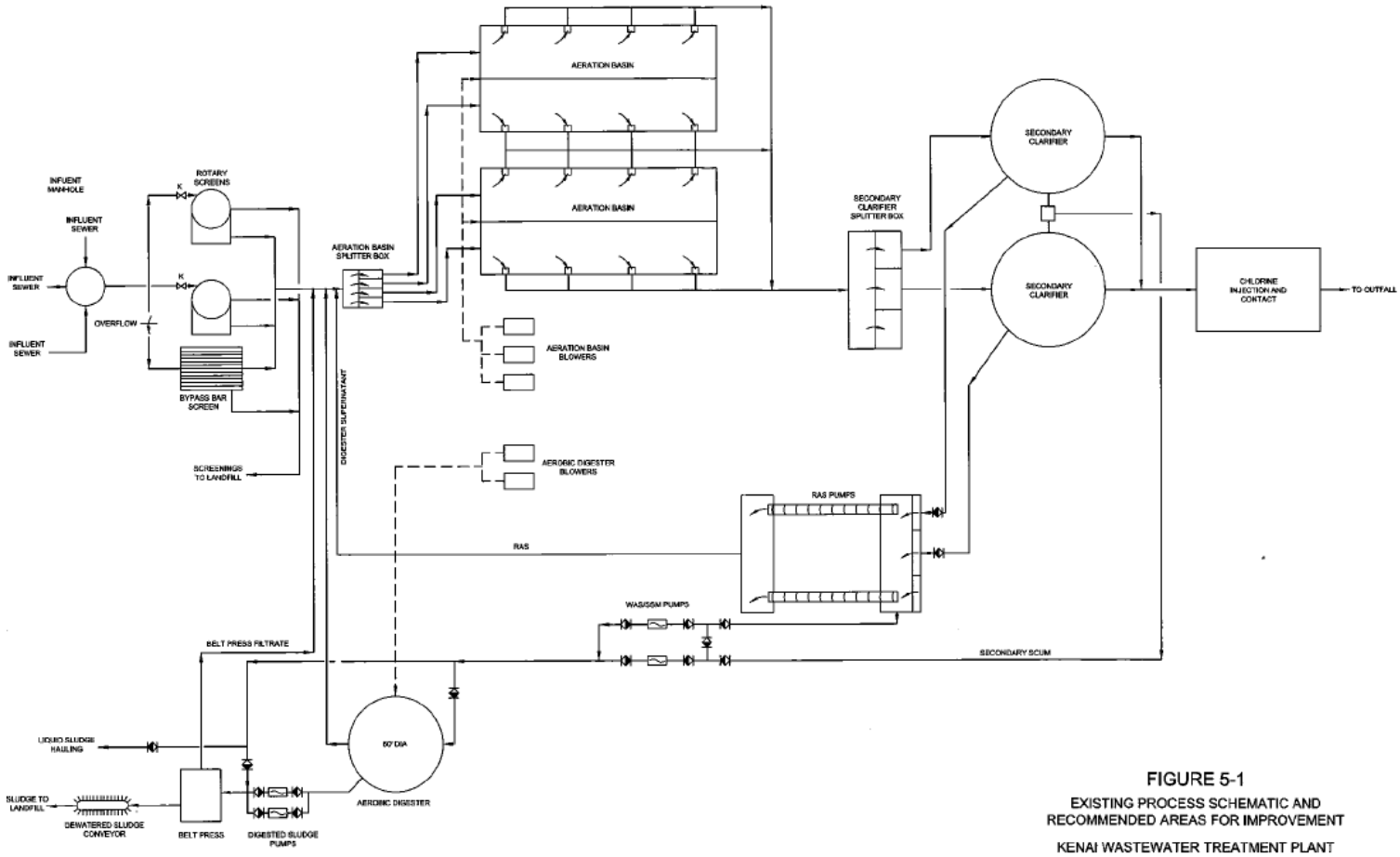


FIGURE 5-1
EXISTING PROCESS SCHEMATIC AND RECOMMENDED AREAS FOR IMPROVEMENT
KENAI WASTEWATER TREATMENT PLANT

2.3 Pollutants of Concern

Pollutants of concern known to be present in the effluent of the Kenai WWTF consist of domestic wastewater conventional pollutants regulated in the technology-based effluent limits (TBELs) via the secondary treatment standards, including BOD_5, TSS, temperature and pH. Additional domestic wastewater pollutants known to be in the discharge are total ammonia as nitrogen (ammonia), fecal coliform (FC) bacteria, and DO. As the Kenai WWTF has a design flow larger than 1.0 mgd, Whole Effluent Toxicity (WET) is a pollutant of concern as required under 18 AAC 83.335(b)(1). More information about WET requirements can be found in Fact Sheet Part 3.4.

Chlorine is a pollutant of concern, as the Kenai WWTF uses chlorine in its disinfection process.

The previous APDES permit identified additional pollutants of concern from priority pollutant scans conducted prior to reissuance and the required additional monitoring for specific parameters. Additional monitoring was required to provide a robust dataset to establish water quality-based effluent limits (WQBELs), if necessary. The parameters monitored in the previous APDES permit cycle were enterococci bacteria, total recoverable copper (copper), total recoverable zinc (zinc), and TRC. Based on results of the additional monitoring, these parameters remain pollutants of concern. Quarterly monitoring of copper and zinc required in the previous permit is continued in the permit. Monitoring of enterococci bacteria (enterococci) required in the previous permit is continued; however, monthly monitoring for enterococci is changed from year-round weekly monitoring to monthly monitoring during the summer season only; to be conducted at the same time as monitoring for FC bacteria. The summer season is defined as the time period between May 1 and September 30. For more information about enterococci, copper and zinc monitoring requirements, see Fact Sheet Part 3.3 and Appendix A.

2.4 Compliance History

DEC reviewed Discharge Monitoring Reports (DMRs) from August 1, 2015 through July 31, 2020 to determine the facility's compliance with effluent limits during the previous permit cycle. DMRs have been submitted consistently on time since September 2015. The DMR review showed no effluent limit exceedances or violations for Outfall 001A. Seven non-compliance notifications (NCNs) were received during the previous permit cycle in 2017 and 2018 and one was received in July 2020. The causes of all non-compliance events were determined and, for the 2017 and 2018 NCNs, the facility repaired faulty equipment and implemented improved internal procedures for collecting samples. On July 27, 2020 DEC informed the City that the Department determined that the operators' use of in-house analytical methods from November 30, 2019 to July 2020 for the analyses of zinc and copper in the effluent conflicted with the Kenai WWTF Quality Assurance Project Plan (QAPP) and was also not supported by the permit condition 1.2.6 for APDES permit AK0021377. This communication resulted in an NCN for the Kenai WWTF. Subsequent to the NCN report, the City resumed using an outside laboratory to analyze copper and zinc effluent samples, in accordance with the permit and their QAPP, and the NCN was resolved.
No enforcement actions brought against the permittee during the previous permit cycle and no citizen complaints were lodged against the facility. Two facility inspections were performed during the previous permit cycle on February 9, 2017 and November 6, 2019.

The February 9, 2017 facility inspection report documented that a receiving water monitoring station had not been established outside the mixing zone and ambient monitoring was not being completed quarterly, as required by the permit conditions. Also, the inspectors found that shoreline signs did not include the permit number or the approximate location and size of the mixing zone. The inspectors stated that the compliance schedule preliminary report was not received by the due date of February 1, 2016 (six months after the effective date of the final permit) and a compliance schedule draft plan of action was not received by August 1, 2016; also permit conditions. The facility inspection report also stated that that QAPP did not include certain types of

information: (i.e., how the facility will report monthly averages on DMRs when a week overlaps two months, maps with sampling locations, laboratory contact information, and the Quality Assurance/ Quality Control [QA/QC] plans for the ambient receiving water monitoring.) The inspection found that four tablets were stored in a pH buffer 7 container, therefore the expiration of the buffer was unknown. The inspectors reported that an annual review of the Operations & Maintenance (O&M) Plan was not available for 2015 and 2016, that the facility's sampling equipment was in poor condition and that DMRs submitted to DEC since August 2015 do not contain a signature date. Finally, the inspection found that the facility was reporting a monthly minimum instead of a calculated monthly average for BOD_5, TSS and FC bacteria. On February 5, 2016, a request for a six-week extension was submitted to DEC and on February 29, 2016 the draft plan was submitted to DEC. On November 15, 2017, the City provided the location of the ambient water monitoring station to DEC, along with the sampling results of the ambient water monitoring events. On August 20, 2019, DEC accepted both corrective actions. The receiving water monitoring station had been established prior to 2017, but the location had not been approved by DEC and receiving water monitoring results had not been provided to DEC. Following the inspection report, DEC received the location of the receiving water monitoring station and the City provided receiving water monitoring results to DEC.

The November 9, 2019 facility inspection report documented no violations. An observed area of concern was that the blower pressure lines that feed the digester were observed to be leaking, causing bubbling of rainwater on the parking area between the main treatment facility and the WAS Tank. While the leaking air does not cause any unpermitted discharge, it is indicative of aging infrastructure that should be addressed.

The Kenai WWTF corrected deficiencies reported in the 2015 and 2017 compliance inspections and other than the non-compliance events reported, routinely produces high quality secondary treatment effluent with BOD_5 and TSS removal rates usually greater than 94%.

2.4.1 2015 Permit Compliance Schedule

The previous permit included a compliance schedule authorized for ammonia. In the previous permit, DEC determined that the City could not immediately comply with newly applied WQBELs for ammonia upon the effective date of the permit because the City needed time to perform modifications to their facility or operational procedures in order to meet the new WQBELs. DEC's analysis demonstrated reasonable potential for ammonia to exceed water quality criteria at the boundary of the chronic mixing zone and calculated ammonia WQBELs to be imposed. DEC required the permittee to identify the cause of the increase in ammonia concentrations observed from 2008 – 2013 and determine a feasible solution that would likely involve significant upgrades to the Kenai WWTF's existing infrastructure.

DEC developed a compliance schedule in the previous permit with a maximum timeline of ten years in order to provide an appropriate and reasonable timeframe to achieve compliance with the new ammonia WQBELs. The compliance schedule required annual progress reports, interim ammonia effluent limits and monitoring requirements, per 18 AAC 83.560(b) which states that interim requirements and dates for their achievement must be established. The compliance schedule took into account regulatory requirements and the fact that a timeline for completing any possible upgrades would depend on funding availability. By 2017, the City met some requirements imposed by the compliance schedule set forth in the 2015 permit and had improved ammonia concentrations in the effluent sufficiently to meet the final ammonia limits set forth in the permit. Interim and final ammonia limits are shown in Table 2. Completion of all the requirements of the 2015 compliance schedule were finalized in June 2020, when DEC issued the facility a final approval to operate notice.

Table 2: Interim and Final Ammonia Effluent Limits Required by 2015 Permit

Parameter	Units	Effluent Limits [a]			Monitoring Frequency		
		Average Monthly	Average Weekly	Maximum Daily	Sample Location	Sample Frequency	Sample Type
Interim Limits: Total Ammonia, as Nitrogen (N)	Milligrams per liter (mg/L)	34	38	38	Effluent	1/Month	24-hour Composite
Final Limits: Total Ammonia, as Nitrogen (N)	mg/L	14	21	29	Effluent	1/Month	24-hour Composite

The compliance schedule history with deadlines for milestones and an account of how and when the permittee met the required milestones is provided below.

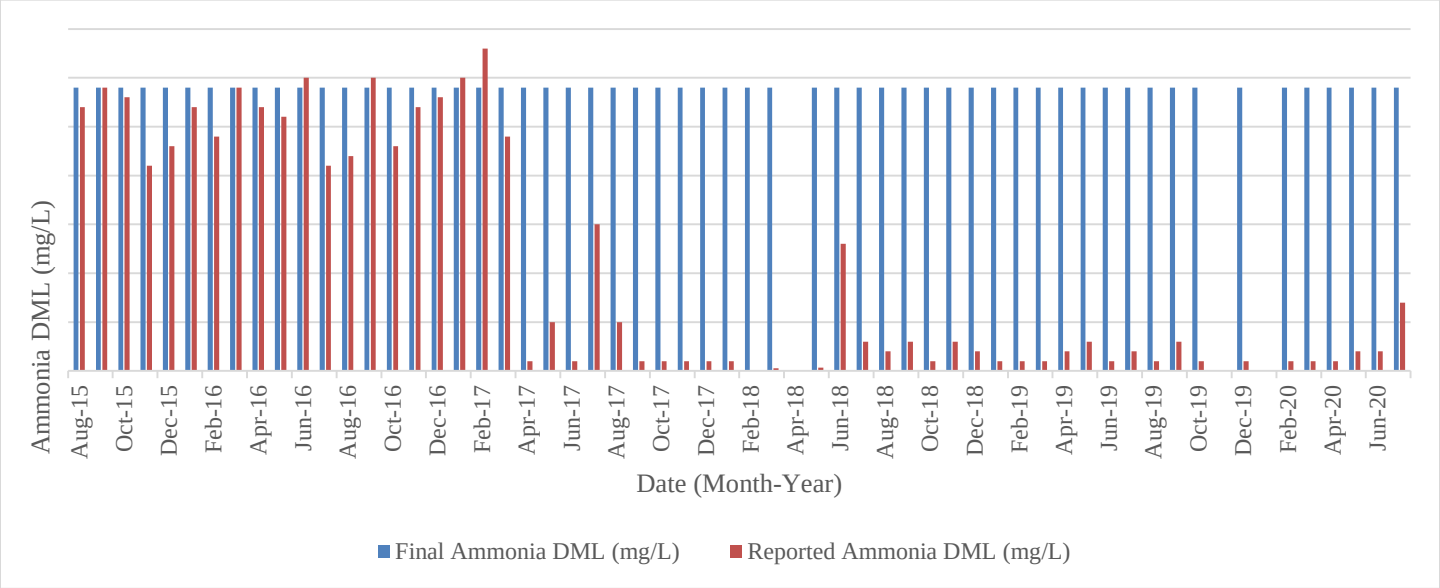
- The first compliance schedule action from the 2015 permit, Section 1.3.3.1, required the City to provide a preliminary report evaluating possible causes of increased ammonia concentrations to be due by February 1, 2016. On February 5, 2016, the City emailed DEC with a report about the possible causes of increased ammonia being caused by sampling procedure problems and lack of control of aeration in the aeration basins and followed up with possible solutions to the problem of increased ammonia: extending the outfall, adding new infrastructure, replacing existing equipment, including automating aeration blowers for DO control and installing a blower upgrade with variable speed blowers and fine bubble diffusers, and modifying plant operations.
- The second compliance schedule action, per permit Section 1.3.3.2, required the City to submit a draft plan of action to DEC for review and approval. The draft plan would identify the chosen solution and the funding needed to enable the permittee to meet final ammonia effluent limits. The deadline for this requirement was August 1, 2016; one year after the effective date of the final permit. On February 29, 2016, the City notified DEC that the chosen plan of action was to install upgraded equipment to the facility and estimated the cost of plant upgrades needed to address the problem of high ammonia concentrations at approximately one million dollars.
- The third and fourth compliance schedule actions, per permit Sections 1.3.3.3 and 1.3.3.4, were funding requirements. DEC required the City to apply for funding to complete the chosen alternative identified in the final DEC-approved plan of action at the first opportunity after August 1, 2015, if outside financing was necessary, to achieve compliance with the final ammonia WQBELs. On December 5, 2016, DEC offered funding through State Revolving Fund (SRF) grant 47555 for ~$980,000 in new funding to be used for design and construct improvements to bring the Kenai WWTF into compliance with current APDES permit requirements and increase operational performance and efficiency. This grant specified the funding had the purpose of achieving effluent ammonia reduction, energy consumption reduction, influent screening, new belt press and controls, digester and related improvements.
- The fifth compliance schedule action, per permit Section 1.3.3.5, required the City to submit a proposed construction schedule with dates for commencement and completion of major construction milestones leading to compliance with final ammonia effluent limits by August 1, 2016. On July 11, 2018, the City provided bid plans and specifications, including an estimate for the cost of installation for new DO

probes at the Kenai WWTF, requesting approval from DEC to proceed with a Notice to Proceed on construction. DEC conditionally issued an approval to construct on December 6, 2018. On October 1, 2019, DEC issued a conditional approval to operate, certifying that the installation of three APG-Neuros high-speed turbo blower systems, along with the replacement and reconfiguration of two SST ALP headers to the aeration basins was complete. DEC issued the final approval to operate on June 24, 2020.

- The sixth and last compliance schedule action, per permit section 1.3.3.6, required the City to achieve compliance with the final ammonia limits as set forth in Part 1.2 Table 2 of the 2015 permit, as soon as possible but no later than August 1, 2025. Until the compliance schedule requirements were completed, interim ammonia effluent limits were in place.

Operational changes and upgrades to the Kenai WWTF infrastructure were effective at reducing ammonia levels in the effluent. Figure 3 is a graph of Daily Maximum Limit (DML) ammonia concentrations, as reported between August 2015 and July 2020. The graph in Figure 3 illustrates that the DML ammonia concentrations were sharply reduced by the spring of 2017 and have remained under the final effluent concentration limits. More information about ammonia can be found in Fact Sheet Part 3.3 and Appendix A.

Figure 3: Kenai WWTF Daily Maximum Ammonia concentrations, 8/2015 – 7/2020



The Kenai WWTF has demonstrated that it can meet the final ammonia effluent limits required by the previous permit, so the interim ammonia effluent limits are superseded by the final ammonia effluent limits and provisions of the compliance schedule imposed in the previous permit have been met.

3.0 EFFLUENT LIMITS AND MONITORING REQUIREMENTS

3.1 Basis for Permit Effluent Limits

Per 18 AAC 83.015, the Department prohibits the discharge of pollutants to waters of the U.S. unless the permittee has first obtained a permit issued by the APDES Program that meet the purposes of AS 46.03 and is in accordance with the CWA Section 402. Per these statutory and regulatory provisions, the Permit includes effluent limits that require the discharger to (1) meet standards reflecting levels of technological capability, (2) comply with 18 AAC 70 – Water Quality Standards (WQS), and (3) comply with other state requirements that may be more stringent.

The CWA requires that the limits for a pollutant be the more stringent of either TBELs or WQBELs. TBELs are set according to the level of treatment that is achievable using available technology. A WQBEL is designed to ensure that the WQS are met. WQBELs may be more stringent than TBELs.

The permit contains a combination of both TBELs and WQBELs. The Department first determines if TBELs are required to be incorporated into the permit. TBELs for publicly owned treatment works (POTWs), which apply to the Kenai WWTF, are derived from the secondary treatment standards found in Title 40 Code of Federal Regulations (40 CFR) §133.102 and 40 CFR §133.105, adopted by reference 18 AAC 83.010(e). The following section summarizes the proposed effluent limits. A more expansive technical and legal basis for the proposed effluent limits is provided in Appendix A Basis for Effluent Limitations.

3.2 Basis for Effluent and Receiving Water Monitoring

In accordance with AS 46.03.110(d), the Department may specify in a permit the terms and conditions under which waste material may be disposed. Monitoring in a permit is required to determine compliance with effluent limits. Monitoring may also be required to gather effluent and receiving water data to determine if additional effluent limits are required and/or to monitor effluent impact on the receiving waterbody quality.

The Department may also require the permittee to perform the additional effluent monitoring required by the APDES application Form 2A for POTWs, so that this data will be available when the permittee applies to reissue the APDES permit. The permittee is responsible for conducting the monitoring and submitting the results with the application for renewal of the APDES permit. The permittee should consult and review Form 2A upon permit issuance to ensure that the required monitoring in the application will be completed prior to submitting a request for permit renewal. A copy of Form 2A can be found at http://dec.alaska.gov/water/wastewater/permit-entry/domestic-and-municipal/.

3.3 Effluent Limits and Monitoring Requirements

The permit contains a combination of both TBELs and WQBELs. The following summarizes the proposed effluent limits. A more expansive technical and legal basis for the proposed effluent limits is provided in Appendix A.

The permit contains new or revised WQBELs for ammonia, enterococci bacteria, and copper and new monitoring requirements for DO and phosphorus. The WQBELs for TRC and FC are carried forward from the previous permit. In addition, the permit includes requirements to monitor the effluent for WET. Data will be used to conduct future reasonable potential analyses to determine if discharges of these parameters might cause an exceedance of the WQS in the receiving waterbody.

Monitoring frequencies are based on the nature and effect of the pollutant, as well as a determination of the minimum sampling necessary to adequately monitor the facility's performance and to evaluate effluent quality and variability. The permittee has the option of taking more frequent samples than required under the permit. These additional samples must be used for averaging (for pollutants results reported on a monthly or weekly average) if they are conducted using the Department – approved test methods (generally found in 18 AAC 70 and 40 CFR Part 136 [adopted by reference in 18 AAC 83.010]).

For all effluent monitoring, the permittee must use a sufficiently sensitive Environmental Protection Agency (EPA) approved test method that quantifies the pollutants to a level lower than applicable limits or water quality standards or use the most sensitive test method available, per Title 40 Code of Federal Regulations (CFR) §136 (Guidelines Establishing Test Procedures for the Analysis of Pollutants), adopted by reference at 18 AAC 83.010(f).

The permit requires pretreatment influent monitoring and effluent monitoring at Outfall 001A. The permit carries forward the monitoring requirements and effluent limits for BOD_5, TSS and pH from the previous permit. Effluent limits are based on the secondary treatment standards adopted in 18 AAC 83.010(e). This includes the permit requirement to monitor the influent for BOD_5 and TSS to calculate monthly removal rates

for these parameters. Further information outlining the details of the effluent limits and monitoring requirements for Outfall 001A can be found in Table 3 and in Appendix A.

The permit requires continued weekly monitoring for temperature because temperature is a pollutant of concern. Monitoring during the previous permit cycle demonstrated that that the temperature of the effluent frequently exceeded WQS at 18 AAC 70.020(b)(22)(A)(i). Temperature fits within the authorized chronic mixing zone. More information about temperature can be found in Appendix A.

A new condition in the permit requires monthly monitoring of DO. DO concentrations in the effluent are based on the requirements of 18 AAC 70.010(15)(A)(i). Facility changes and upgrades to the Kenai WWTF, including installation of DO probes and aeration basin improvements completed during the previous permitting period were undertaken to reduce ammonia levels, but may also have affected DO concentrations in the effluent. A DO value of 7.69 mg/L was reported for January 2019 and a DO result of 9.84 mg/L was reported for January of 2020, both results above the minimum WQS of 6 mg/L; however DO is a parameter of concern in domestic wastewater treatment and the permit requirement to monitor DO on a monthly basis will provide information about the effluent. More information about recent facility upgrades be found in Fact Sheet Part 2.4.1.

A new condition in the permit requires quarterly monitoring for phosphorus. Phosphorus is a parameters of concern based on results of extended effluent testing undertaken in the previous permit cycle in 2018 and 2020. Expanded effluent testing in December 2016, December 2017, and January 2020 yielded phosphorus results of 0.954 mg/L, 0.744 mg/L and 3.59 mg/L, respectively; all results exceeding the most stringent WQS for phosphorus at 0.1 micrograms per liter (µg/L) for marine water, listed in the 2008 Alaska Water Quality Criteria Manual for Toxic and other Deleterious Organic and Inorganic Substances (Toxics Manual). The frequency of phosphorus monitoring is once per quarter and will provide a sufficiently robust dataset to determine if phosphorus has reasonable potential to exceed WQS.

The permit requires the monitoring of TRC. Effluent limits are based on standard operating procedures for domestic wastewater facilities that use chlorine to disinfect wastewater, applicable to the Kenai WWTF. The monitoring requirement and effluent limits are carried forward from the previous permit. More information about TRC can be found in Appendix A.

The permit requires monitoring of FC and enterococci bacteria. Effluent limits for both FC and enterococci are WQBELs based on WQS. The DML for FCof 43 FC/100 mL and the Average Monthly Limit (AML) of 14 FC/100 mL are carried forward from the previous permit, as is the weekly monitoring requirement. The permit includes a requirement for monitoring enterococci. Enterococci are indicator organisms of harmful pathogens in fresh water and are a better indicator of acute gastrointestinal illness than are FC bacteria. The monitoring requirement for enterococci has changed from the previous permit. The previous permit required weekly monitoring for enterococci bacteria year-round, but the current permit requires monthly monitoring for enterococci bacteria during the summer season only; defined as the time period between May 1 to September 30. The reason for the change from weekly to monthly-only monitoring is for consistency with permitting requirements for other POTWs. The reason for the change from year-round to seasonal monitoring for enterococci is for consistency with EPA's recommended recreational water quality criteria (RWCQ). The RWCQ adopts enterococci as the recommended contact recreation WQ criteria for marine waters during the summer season when primary contact recreation is more likely to occur. In the previous permitting period, enterococci results were found to exceed the WQS twice for the daily maximum criterion and twice for the monthly geomean maximum during the summer season, but were generally found to be in very low levels in the effluent and the facility has indicated that WQS for enterococci can be met with the faciliy's disinfection treatment. Effluent monitoring for enterococci is required to be performed in conjunction with FC monitoring. The DML for enterococci of 130 cfu/100 mL and the AML of 35 cfu/100 mL are new WQBELs in the permit. More information about FC and enterococci can be found in Appendix A.

When evaluating the effluent to determine if WQBELs based on chemical-specific numeric criteria are needed, the Department projects the receiving waterbody concentration (RWC) for each pollutant of concern outside the

mixing zone of where the effluent enters the waterbody. The chemical-specific concentration of the effluent and receiving waterbody and, if appropriate, the dilution available from the receiving waterbody, are factors used to project the RWC. The operation used to calculate WQBELs is called a reasonable potential analysis (RPA). An RPA is an assessment by which a limited parameter's maximum observed effluent concentration (MOC) is statistically multiplied to obtain a maximum expected concentration (MEC). If the MEC, a the projected concentration of a limited parameter in the receiving waterbody, exceeds the numeric criterion for the parameter, then there is reasonable potential (RP) that the discharge may cause or contribute to an excursion above the applicable WQS, and a WQBEL must be developed. If the projected concentration of the receiving waterbody is lower than the numeric criterion for a limited parameter, then there is not RP that the discharge may cause or contribute to an excursion above the applicable WQS and it is expected that the effluent will meet WQS at the point of discharge. The effluent limits that would be applied are the WQS for the limited parameter.

The permit includes new effluent limits for ammonia and requires continued monitoring for ammonia. Ammonia was the driver of the chronic mixing zone during the previous permit cycle and also the driver of the chronic mixing zone in the current permit. An RPA of ammonia data collected during the previous permit cycle reveals that concentration of ammonia present in the effluent of the Kenai WWTF has RP to exceed the aquatic life marine water standards. DEC derived ammonia criteria from the Toxics Manual. Consistent with the *APDES Permits Reasonable Potential Analysis and Effluent Limits Development Guide* (RPA Guide), the salinity and the 85th percentile of the pH and temperature of the receiving water data provided by the City was used to calculate the ammonia criteria from tables contained in Appendices F and G of the Toxics Manual. The toxicity of ammonia is dependent on pH, temperature, and salinity; therefore, the criteria are also pH, temperature, and salinity dependent. The 85th percentile receiving water pH was 7.9 Standard Units (S.U.), the 85th percentile of receiving water body temperature was 15.1 degrees Celsius (^{o}C), and salinity was 26.7 grams per kilogram (g/kg). The acute ammonia numeric WQS criterion was calculated to be 10.5 mg/L and the chronic criterion was determined to be 1.6 mg/L. Consistent with the RPA Guide, the Department determined the daily maximum ammonia effluent limit to be 27 mg/L and the average monthly ammonia effluent limit to be 8.8 mg/L. The monthly monitoring frequency for ammonia is carried forward from the previous permit. More information about ammonia can be found in Appendix A. More information about the effluent limits calculated for ammonia using the RPA Guide can be found in Appendix B. More information about mixing zone calculations can be found in Part 4.5.

The permit includes new effluent limits for copper. Copper was identified as a pollutant of concern in the previous permit and was the driver of the acute mixing zone and also is the driver of the acute mixing zone in the current permit. An RPA of the effluent copper data obtained during the previous permit cycle demonstrated that copper has an RP to exceed the aquatic life marine WQS. The acute copper numeric WQS criterion was calculated to be 5.8 μg/L and the chronic criterion was determined to be 3.7 μg/L. Consistent with the RPA Guide, the Department determined the DML for copper to be 15 μg/L and the AML for copper to be 9.9 μg/L. The monitoring frequency is carried forward from the previous permit. A quarterly monitoring frequency requirement for copper will sufficiently monitor the facility's performance and variability and produce a robust dataset to conduct reasonable potential analysis for the next permit reissuance. More information about the effluent limits calculated for copper using the RPA Guide can be found in Appendix B. More information about mixing zone calculations can be found in Part 4.5.

The permit includes continued quarterly monitoring for zinc. Zinc was identified as a pollutant of concern in the previous permit and an RPA of the effluent zinc data obtained during the previous permit cycle demonstrated that zinc has an RP to exceed the aquatic life marine WQS.The acute zinc numeric WQS criterion was calculated to be 95.1 μg/L and the chronic criterion was determined to be 86.1 μg/L. More information about zinc can be found in Appendix A.

The permit does not require monitoring for other parameters because expanded effluent testing required three times during the previous permitting period did not identify other parameters of concern.

Influent and effluent monitoring requirements and effluent limits are summarized in Table 3.

Table 3: Outfall 001A: Effluent Limits and Monitoring Requirements

Parameter	Effluent Limits					Monitoring Requirements		
	Units [a]	Daily Minimum	Monthly Average	Weekly Average	Daily Maximum	Sample Location	Sample Frequency	Sample Type
Total Discharge Flow	Mgd	N/A	1.3	Report	1.44	Effluent	Continuous	Recorded
Biochemical Oxygen Demand (BOD_5)	mg/L	N/A	30	45	60	Influent and Effluent [c]	1/Week	24-hour Composite [d]
	lbs/day [b]		325	488	650			Calculated
Total Suspended Solids (TSS)	mg/L	N/A	30	45	60	Influent and Effluent	1/Week	24-hour Composite
	lbs/day		325	488	650			Calculated
BOD_5 & TSS Minimum Percent (%) Removal	%	N/A	85 [e]	N/A	N/A	Influent and Effluent	1/Month	Calculated
pH	S.U.	6.5	N/A	N/A	8.5	Effluent	5/Week	Grab
Temperature	°C	N/A	N/A	N/A	Report	Effluent	1/Week	Grab
Dissolved Oxygen (DO)	mg/L	N/A	N/A	N/A	Report	Effluent	1/Month	Grab
Total Residual Chlorine (TRC) [f]	mg/L	N/A	0.0075	N/A	0.013	Effluent	5/Week	Grab
Fecal coliform Bacteria (FC)	FC/ 100 mL	N/A	14 [g]	N/A	43 [h]	Effluent	1/Week	Grab
Enterococci Bacteria	cfu/ 100 mL	N/A	35 [g]	N/A	130 [h]	Effluent	1/Month [i]	Grab
Total Ammonia, as N	mg/L	N/A	8.8	21	27	Effluent	1/Month	24-hour Composite
	lbs/day	N/A	95	228	293			
Copper, total recoverable	µg/L	N/A	9.9	12.5	15	Effluent	1/Quarter [j]	24-hour Composite
	lbs/day	N/A	107	135	163			
Zinc, total recoverable	µg/L	N/A	N/A	N/A	Report	Effluent	1/Quarter	24-hour Composite
Total Phosphorus	mg/L	N/A	NA	NA	Report	Effluent	1/Quarter	24-hour Composite

Footnotes:

a. Units: mgd = million gallons per day, mg/L = milligrams per liter, lbs/day = pounds per day, S.U. = standard units, °C= degrees Celsius,
FC/100 mL = Fecal Coliform per 100 milliliters, cfu/100 mL = colony forming units per 100 milliliters, µg/L = micrograms per liter.

b. Loading in lbs/day = concentration (mg/L) x flow (mgd) x 8.34 (conversion factor). All loading limits are calculated using a design flow rate of 1.3 mgd.

c. Limits apply to effluent. Report average monthly influent concentration. Influent and effluent composite samples shall be collected during the same
24-hour period.

d. See Appendix C for definition.

e. Minimum % Removal = [(monthly average influent concentration in mg/L – monthly average effluent concentration in mg/L) / (monthly average influent concentration in mg/L)] x 100. The monthly average percent removal must be calculated using the arithmetic mean of the influent value and the arithmetic mean of the effluent value for that month.

f. The TRC effluent limits are not quantifiable using EPA-approved analytical methods. DEC will use the minimum level (ML) of 0.1 mg/L as the compliance evaluation level for this parameter.

g. If more than one bacteria sample is collected within the reporting period, the average result must be reported as the geometric mean. When calculating the geometric mean, replace all results of zero, 0, with a one, 1. The geometric mean of "n" quantities is the "nth" root of the product of the quantities. For example, the geometric mean of 100, 200, and 300 is $(100 \text{ X } 200 \text{ X } 300)^{1/3} = 181.7$.

h. When only one sample is collected, the effluent limit cannot be exceeded. If ten or more samples are collected during the monthly reporting period, not more than 10% of the samples may exceed the effluent limit

i. One enterococci sample shall be collected each month, May through September, on the same day as a fecal coliform bacteria sample is collected.

j. Once per quarter means once every three months based on the calendar year beginning with January: Jan–March, April–June, July–Sept, and Oct–Dec.

3.4 Whole Effluent Toxicity Monitoring

Alaska WQS at 18 AAC 70.030 require that an effluent discharged to a water may not impart chronic toxicity to aquatic organisms, expressed as 1.0 Chronic Toxic Units (TUc), at the point of discharge, or if the Department authorizes a mixing zone in a permit, approval, or certification, at or beyond the mixing zone boundary, based on the minimum effluent dilution achieved in the mixing zone. 18 AAC 83.435 requires that a permit contain limitations on WET when a discharge has reasonable potential to cause or contribute to an exceedance of a WQS. 18 AAC 83.335 recommends chronic testing for facilities with dilution factors less than 100:1 at the boundary of the mixing zone, acute testing for facilities with dilution factors greater than 1000:1 at the boundary of the mixing zone, and either acute or chronic testing for dilution factors between 100:1 and 1000:1 at the boundary of the mixing zone.

WET tests are laboratory tests that measure total toxic effect of an effluent on living organisms. WET tests use small vertebrate and invertebrate species and/or plants to measure the aggregate toxicity of an effluent. WET testing is included in the permit to demonstrate any potential toxicity resulting from the WWTF discharge. The two different durations of toxicity tests are: acute and chronic. Acute toxicity tests measure survival over a 96-hour exposure. Chronic toxicity tests measure reductions in survival, growth, and reproduction over a 7-day exposure.

The previous permit required that the City conduct annual chronic toxicity tests, at a minimum, twice per year in both summer and winter seasons on the test organisms *Strongylocentrotus purpuratus* (purple sea urchin) or *Dendraster excentricus* (sand dollar). For WET testing purposes, summer seasons were defined as the period between May 1 and October 31 and winter seasons were defined as the period between November 1 and April 30.

In the previous permit, a total of five chronic toxicity tests for both testing species were performed. Fertilization tests were conducted on 24-hour flow composited final effluent samples. The organisms were tested at the five following effluent concentrations: 11.2%, 8.5%, 5.6%, 2.8%, and 1.4% and a control (0% effluent). Complete

results of the WET testing permitting conducted during the previous permitting period for the Kenai WWTF are shown in Table 4.

The toxicity trigger for chronic WET testing in the previous permit was 18 TUc. All but one of the WET results consistently returned TUc (100/NOEC) values of 8.93. The previous permit identified 8.9 TUc as the concentration that was used to determine reasonable potential to exceed water quality criteria at the end of pipe but not at the boundary of the chronic mixing zone. The June 2019 TUc (100/NOEC) result was 17.86; close to but not equaling or exceeding the TUc trigger of 18. Even though the TUc trigger was not met or exceeded, the elevated result from the Summer 2019 WET test demonstrates the need for WET testing in the current permit.

Table 4: Kenai WWTF Chronic WET Testing Results, 2015 – 2020

	Dendraster excentricus						*Strongylocentrotus purpuratus*					
Start Date	**Test**	**TUc = 100/NOEC**	**TUc = 100/IC25**	**IC25**	**NOEC**	**LOEC**	**Test**	**TUc = 100/NOEC**	**TUc = 100/IC25**	**IC25**	**NOEC**	**LOEC**
Jun-15	Fertilization	8.93	N/A	N/A	100%	N/A						
Dec-15	Fertilization	8.93	<1.0	>100%	100%	>100%						
Jun-16							Fertilization	8.93	<1.0	>100%	100%	>100%
Dec-16							Fertilization	8.93	<1.0	>100%	100%	>100%
May-17							Fertilization	8.93	<1.0	>100%	100%	>100%
Nov-17							Fertilization	8.93	<1.0	>100%	100%	>100%
Jun-18							Fertilization	8.93	<1.0	>100%	100%	>100%
Nov-18							Fertilization	8.93	<1.0	>100%	100%	>100%
Jun-19	Fertilization	17.86	13.62	7.34%	5.6%	8.4%						
Dec-19							Fertilization	8.93	<1.0	>100%	100%	>100%
Jun-20							Fertilization	8.93	<1.0	>100%	100%	>100%

In order to provide ongoing assessment of the toxicity of the Kenai WWTF wastewater discharge, and ensure compliance with 18 AAC 83.335, annual effluent monitoring for WET is required in the permit. WET monitoring in this permit will also satisfy the WET monitoring requirements in Application Form 2A for permit reissuance.

The City will conduct WET testing in the summer season, May 1 – October 31.

There are no chronic toxicity effluent limits for this discharge. The permit test dilution series has been changed from the previous permit because the dilution factor (DF) for the chronic mixing zone has changed from 18 to 17.4. The permit dilution series is 23%, 11.5%, 5.7%, 2.9%, 1.4%, and a control (0%) and the TUc trigger has been adjusted in this permit from the previous permit. The permit requires accelerated WET testing if the toxicity is greater than or equal to 17.4 TUc in any test. If the toxicity equals or exceeds the permit trigger, six biweekly WET tests (every two weeks over a 12-week period) is required. If the City demonstrates that corrective actions have been implemented, only one accelerated test is required. If toxicity is greater than or equal to 17.4 TUc in any of the accelerated tests, the City must initiate a Toxicity Reduction Evaluation (TRE). A TRE is required so that specific cause of the toxicity can be identified and mitigated (see Permit Section 1.3.6 for further details).

3.5 Receiving Waterbody Limits and Monitoring

Cook Inlet is protected for all marine designated use classes per 18 AAC 70.020(a): water supply for aquaculture, seafood processing and industry; contact and secondary recreation; growth and propagation of fish, shellfish, other aquatic life, and wildlife; and harvesting for consumption of raw mollusks or other raw aquatic life. The City monitored Cook Inlet outside the authorized Kenai WWTF mixing zone during the previous permit cycle for ammonia, temperature, salinity, and pH.

3.5.1 Receiving Waterbody Monitoring Requirements

The 2015 permit authorized a chronic mixing zone defined as the area within a circle of 150-meter radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface when the outfall pipe was submerged and area within a half-circle of 150-meter radius, centered on the point where the discharge

entered marine water, when the outfall pipe was not submerged. The previous permit included a receiving waterbody monitoring requirement to determine ambient conditions for ammonia, temperature, pH and salinity in Cook Inlet outside the authorized mixing zone. Receiving water body monitoring data from September 2015 to December 2020 was used in the development of the current permit. The permit continues to require monitoring of the receiving water at one location outside the boundary of the mixing zone to be identified by the permittee and approved by the Department. The permittee is required to identify a new monitoring station location because the chronic mixing zone area in the current permit has been reduced relative to the area of the chronic mixing zone in the previous permit. Receiving water monitoring must start within 120 days of the effective date of the permit and continue for the duration of the permit and the location must be approved by the Department (see permit section 1.5). Ambient receiving water body monitoring results must be submitted to DEC with the application for permit reissuance. Table 5 summarizes the ambient station monitoring requirements.

The permit authorizes a mixing zone for ammonia, temperature, zinc, copper, and chronic WET. Results of monitoring outside the influence of the facility's discharge will provide information about water quality in the receiving water. There is no reasonable potential for DO, TRC, FC or enterococci bacteria to exceed water quality criteria at the boundary of the mixing zone. Chronic WET will not be monitored in the receiving water as chronic WET testing already measures the effluent with respect to an established dilution series, which is consistent with the 2015 permit requirement.

Receiving water monitoring of salinity, pH, and temperature at the monitoring station is required in the permit to determine ammonia water quality criteria for future permit issuances. Receiving water monitoring for copper is a new requirement in the permit. Copper is the parameter driving the acute mixing zone and is the parameter that determines lethality to organisms passing through the acute mixing zone, so the concentration of copper in the ambient environment will be important to future RPA calculations.

To the extent practicable, receiving water sample collection must occur on the same day as effluent sample collection for parameters specified in Table 2. Also, when practicable, receiving water monitoring is to take place during different months of the year in the summer and winter seasons. The summer season is defined as the period between May 1 and October 31 and the winter period is defined as the period between November 1 and April 30.

The previous permit required receiving water monitoring frequency to occur once each quarter (January – March, April – June, July – September, and October – December). The frequency of receiving water monitoring has been reduced in the current permit to twice a year, in alternating seasons, because sufficient receiving water data exists to establish baseline levels for ambient ammonia, temperature, pH, and salinity and additional receiving water monitoring at a reduced frequency will provide sufficient data for future RP analyses. Monitoring data collected from receiving waters must be compiled and submitted with the DMR for the month following sample collection, per Section 1.5.5 of the permit. Data submitted in the report will be used for future permit issuances. Table 5 lists receiving water monitoring requirements.

Table 5: Receiving Water Body Monitoring Requirements

Parameter	Units [a]	Sample Frequency	Sample Type
pH	SU	Once per season [b]	Grab
Temperature	°C		
Salinity	Ppt		
Total Ammonia as Nitrogen	mg/L		
Copper, total recoverable	µg/L		

Footnotes:

a. Units: SU = standard units, °C= degrees Celsius, Ppt = part per thousand, mg/L = milligrams per liter, µg/L = micrograms per liter.

b. Summer season: May 1 – October 31; Winter season: November 1 – April 30.

4.0 RECEIVING WATERBODY

4.1 Description of Receiving Waterbody

The Kenai WWTF discharges treated effluent into Cook Inlet at latitude 60.5522° North, longitude 151.2777° West. Cook Inlet is located in south-central Alaska, extending180 miles from the Gulf of Alaska to Anchorage. Cook Inlet provides navigable access to Anchorage, smaller cities on the Kenai Peninsula, and many villages and communities along Cook Inlet's shoreline. Tidal currents in Cook Inlet flow predominately northeast and southwest with very low cross-component flow. The tidal currents are semi-diurnal in nature with slightly stronger flood tides (northerly) as compared to the ebb tides (southerly), which is typical for the eastern side of Cook Inlet.

4.2 Outfall Description

The Kenai WWTF continually discharges treated and dechlorinated effluent into Cook Inlet through a 12-inch riser pipe extending upwards from the 18-inch diameter outfall pipe that runs approximately 400 ft from the facility to mean high water and continues offshore perpendicular to the shoreline for 1,300 ft. Effluent discharged to Outfall 001A flows upward through a single riser port. An orifice plate with a 9.5-inch diameter opening is affixed to the top of the riser. The outfall is designed to discharge effluent one foot above the tidal flat. The receiving is shallow and as a result, the effluent line is exposed for up to three or four hours per day during negative low tides. The elevation of discharge relative to the tidal flat is -5.6 ft mean sea level (5.3 ft above MLLW). During the time the outfall is exposed, the discharge travels across the tidal flats in a stream where it ultimately reaches Cook Inlet.

Outfall 001A terminus does not have intermittent or periodic discharges. Geographic coordinates of the outfall are 60.5522° North latitude and 151.2777° West longitude.

4.3 Water Quality Standards

Section 301(b)(1)(C) of the CWA required the development of limits in permits necessary to meet water quality standards by July 1, 1977. Per 18 AAC 83.435, APDES permits must include conditions to ensure compliance with WQS. Additionally, regulations in 18 AAC 70 require that the conditions in permits ensure compliance with the WQS. The State's WQS are composed of waterbody use classifications, numeric and/or narrative water quality criteria, and an Antidegradation Policy. The use classification system identifies the designated uses that each waterbody is expected to achieve. The numeric and/or narrative water quality criteria are the criteria deemed necessary by the state to support the designated use classification of each waterbody. The

antidegradation policy ensures that the existing uses and the level of water quality necessary to protect the uses are maintained and protected.

Water bodies in Alaska are designated for all uses unless the water has been reclassified under 18 AAC 70.230 as listed under 18 AAC 70.230(e). Some waterbodies in Alaska can also have site–specific water quality criteria per 18 AAC 70.235, such as those listed under18 AAC 70.236(b). The receiving water for this discharge, Cook Inlet, has not been reclassified, nor have site-specific water quality criteria been established. Therefore, existing uses and designated uses are the same and Cook Inlet must be protected for all marine use classes listed in 18 AAC 70.020(a)(2). These marine water designated uses consist of the following: (A) water supply (aquaculture, seafood processing, and industrial), (B) water recreation (contact and secondary), (C) growth and propagation of fish, shellfish, other aquatic life, and wildlife, and (D) harvesting for consumption of raw mollusks or other raw aquatic life.

4.4 Water Quality Status of Receiving Water

Any part of a waterbody for which the water quality does not, or is not, expected to meet applicable WQS is defined as a "water quality limited segment" and placed on the State's impaired waterbody list. Cook Inlet is not included on any of the impaired water body lists catalogued in *Alaska's Final 2018 Integrated Water Quality Monitoring and Assessment Report*, June 23, 2020 (Alaska's 2018 Integrated Report).

4.5 Mixing Zone Analysis

In accordance with 18 AAC 70.240, the Department may authorize a mixing zone in a permit. Determination of the mixing zone requires an evaluation of critical conditions of the flow regimes of the receiving waterbody, effluent characterization and concentration projections, and discharge rates. These critical conditions are addressed in the permit application. A chronic mixing zone is sized to protect the ecology of the waterbody as a whole and an acute mixing zone is sized to prevent lethality to passing organisms.

The previous permit identified ammonia as the parameter that required the most dilution and the determined the chronic mixing zone size necessary to achieve WQS at the boundary of the chronic mixing zone. In the previous permit, the chronic mixing zone size remained the same as in the 2008 permit; defined as the area within a circle, 150-meter radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface. The chronic mixing zone for this discharge at times when the end of the pipe was not under water due to tidal fluctuations. The chronic mixing zone size was defined as the area within a half-circle of 150-meter radius, centered on the point where the effluent enters marine water. The dilution available within the half circle of 150-meter radius was 18:1 and was the chronic mixing zone dilution factor. The previous permit authorized an acute mixing zone with copper as the driving parameter. The acute mixing zone was defined in the previous permit as the area within a circle of seven-meter radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface. The acute mixing zone for this discharge at times when the end of the pipe was not under water due to tidal fluctuations, was defined as the area within a half-circle of a seven-meter radius, centered on the point where the effluent enters marine water. 6.7:1 was the acute mixing zone dilution factor. In the previous permit, all parameters that did not meet WQS at the end of the pipe meet their respective water quality criteria at the boundary of the chronic mixing zone. The parameters included in the chronic mixing zone were ammonia, copper, and zinc.

Since the time when the previous permit was issued, more information about the discharge and receiving environment has been made available. For the current permit, DEC analyzed information made available by the City to conduct an RPA for parameters exhibiting RP to exceed WQS at the end of the pipe and determine acute and chronic mixing zone dilutions and sizes. DEC used recent ambient monitoring data, DMR results from the previous five years, bench data collected from the Kenai WWTF since 2017, and the results of expanded effluent testing conducted from 2015 – 2020. The data demonstrated that copper, zinc, and ammonia were parameters exhibiting RP; the same parameters demonstrating RP in the previous permit. As was determined in

the previous permit, The Department found that FC, DO, pH, TRC, nutrients (with the exception of ammonia), and metals (with the exception of copper and zinc) do not necessitate dilution from a mixing zone. The City's consultant, GV Jones and Associates, facilitated retrieval of the data used in the mixing zone analysis, including providing a report to DEC, the *City of Kenai Revised Mixing Zone Study Report* (SLR Mixing Zone report), prepared by SLR Consulting (SLR).

Other information used in mixing zone modeling were some facility information and ambient current speed information, updated since the previous permit issuance. Current speed is one of the most influential variables in mixing zone modeling. Cook Inlet, adjacent to the Kenai WWTF, lacks site-specific data about current speed; and consequently was the variable introducing the most uncertainty into the mixing zone model. The SLR Mixing Zone report produced a summary of current speed data in Cook Inlet at locations near the Kenai WWTF, listing current speeds calculated at the 10^{th}, 50^{th}, and 90^{th} percentiles. A 2015 Bureau of Ocean Entergy Management (BOEM) study examined surface and bottom current speeds across a grid spanning Cook Inlet. The study concluded that the predicted mean surface current near the City was approximately 0.30 meters/second (m/s) year-round. A 2020 National Oceanic and Atmospheric Administration (NOAA) study estimated 10^{th}, 50^{th}, and 90^{th} percentile current speeds at 0.24, 1.00 and 1.51 m/s. Based on a collective review of the information, it was determined that the best estimates for 10^{th}, 50^{th}, and 90^{th} percentile current speeds in the vicinity of the Kenai WWTF outfall are 0.20, 0.60, and 1.0 m/s, respectively.

Since Outfall 001A for the Kenai WWTF is unsubmerged for up to three to four hours a day, depending on tidal fluctuations in Cook Inlet, characterization of the mixing zone is performed separately for the period when the outfall is unsubmerged (surface discharge) and when the outfall is discharges below the surface of the water (submerged discharge).

Acute and chronic aquatic life criteria were calculated for ammonia, zinc, and copper using data from the ambient water quality monitoring data and in accordance with the RPA Guide. Ambient water pH, salinity, and temperature data were used to calculate chronic and acute aquatic life criteria for ammonia. The 85^{th} percentile of ambient ammonia measured from ambient monitoring results was also used in the RPA. The most stringent criterion for ammonia is the chronic criterion for the protection of aquatic life, given as 1.6 mg/L in Appendix G of the Toxics Manual. There were no receiving water copper or zinc concentrations available, so the RPA Tool calculated the background concentration of copper and zinc as 0.056 µg/L; the 15^{th} percentile of the chronic aquatic life criterion for copper and 12.9 µg/L, the 15^{th} percentile of the chronic aquatic life criterion for zinc This is consistent with the recommendation provided in the RPA Guide. The RPA Tool also calculated the most stringent WQ criteria for copper and zinc; the chronic criteria for the protection of aquatic life at 3.7 µg/L and 86.1 µg/L, respectively. More information about the RPA calculations for copper and ammonia can be found in Part 3.3 and Appendices A-C.

Ambient data and calculated WQC for ammonia are summarized in Table 6.

Table 6: Cook Inlet Receiving Water Monitoring Results, September 28, 2015 to December 7, 2020

Parameter	Units [a]	Minimum Value	Maximum Value	Concentration of Ammonia Used in RPA Analysis	Calculated WQC for Aquatic Life Chronic Criteria
Ammonia, as Nitrogen	mg/L	ND [b]	0.80	0.499	1.6
pH	S. U.	6.7	8.0		
Temperature	°C	-1.0	17		
Salinity	Ppt	18	27		

Footnotes:

a) Unit: mg/L= milligrams per liter; S. U. = Standard Units, °C = degrees Celsius, Ppt = parts per thousand
b) ND = non-detect

DEC received the City's application for reissuance of the permit on June 5, 2020. As part of the application, the City provided laboratory results of the expanded effluent monitoring available at that time. Since June 2020, the City has provided additional monitoring data, including bench sheets, ambient monitoring data and results of new expanded effluent testing performed in October and November 2020.

DEC used CORMIX 11.0 as the mixing zone modeling program for this permit. SLR also used CORMIX 11.0 in their Mixing Zone Report. CORMIX is as an EPA-supported mixing zone model and decision support system for environmental impact assessment of regulatory mixing zones resulting from continuous point source discharges. The CORMIX program requires inputs from parameter concentrations in the effluent and the environment, ambient conditions, and data from facility operations.

The SLR Mixing Zone Report compiled an effluent data summary and subsequently performed an RPA following the DEC's recommended procedures from the RPA Guide. In the analysis, SLR determined that ammonia was the driving parameter for the chronic mixing zone and copper was the driving parameter of the acute mixing zone. SLR determined the dilution factor for the chronic mixing zone to be 23 and that chronic WQS for ammonia would be met at a distance of of 157 m (518 ft) from the outfall. SLR determined that only acute conditions exist when the outfall is not submerged. Additionally, SLR determined that copper was the driving parameter for the acute mixing zone and the dilution factor for the acute mixing zone was 3.1. When the outfall is submerged, SLR determined that WQS for copper would be met at a distance of 28 m (92 ft) and when the outfall was not submerged, WQS for copper would be met at a distance of 45 m (148 ft).The City requested re-authorization of the previously authorized mixing zone for ammonia, copper, zinc and WET with ammonia as the parameter requiring the most dilution.

In accordance with 18 AAC 70.240, DEC modeled the acute and chronic mixing zones and calculated dilution factors. DEC's analysis was based on different inputs to CORMIX, including MECs based on data not available to SLR, chronic WQS calculated for ammonia, based on ambient monitoring data not available to SLR, as well as using different inputs from the site-specific discharge and facility information used by SLR. These inputs included effluent flow rate, distance to the shore, and seafloor depth. DEC ran mixing zone models on three different current speeds; 0.2 m/sec, the 10^{th} percentile current speed, 0.6 m/sec, the 50^{th} percentile current speed, and 1.0 m/sec, the 90^{th} percentile current speed for the submerged discharges and also for side channel discharges from the unsubmerged outfall. Other data required for the mixing zone modeling included the input of receiving water characteristics at the outfall, such as the depth of the receiving water at the outfall, the ambient velocity, wind velocity, bank configuration and distance of the outfall from the bank, and other features. Based on the inputs, CORMIX predicted the distance at which the parameters would meet WQC as

well as the corresponding dilution at the point. A summary of inputs to the CORMIX program used by SLR and by DEC are listed in Table 8.

DEC's analysis resulted in similarities and differences to the conclusions in the SLR Muxing Zone Report. Similiarities to SLR's mixing zone analysis were that ammonia was determined to be the driving parameter for the chronic mixing zone and copper was the driving parameter for the acute mixing zone. Differences with SLR's conclusions were that DEC determined that both chronic and acute conditions are in effect when the outfall is unsubmerged and DEC's models yielded different mixing zone sizes than those given in the SLR Mixing Zone Report. DEC used the most conservative result from the CORMIX model results as the size of the mixing zone from completed CORMIX models. Current speeds at the 10^{th} percentile (0.2 m/sec) resulted in the most conservative, or protective, result for the chronic mixing zone and also for the acute mixing zone. In the unsubmerged discharge, the discharge geometry is a half-circle. In the submerged discharge, the discharge geometry is a full circle.

In DEC's analysis, copper, zinc, temperature, and WET fit within the chronic mixing zone sized for ammonia. The chronic ammonia mixing zone has a dilution factor of 17.4. The chronic mixing zone is defined as the area within a circle of 113.1-m (371-ft) radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface. The chronic mixing zone for this discharge at times when the end of the pipe is not under water due to tidal fluctuations is defined as the area within a half-circle of 113.1-m (371-ft) radius, centered on the point where the effluent enters marine water. The chronic dilution factor remains the same for conditions when the outfall is submerged and when it is exposed above the surface of the water.

In DEC's analysis, the acute mixing zone surrounds the outfall and is contained within the larger chronic mixing zone, with copper as the driving parameter, for conditions when the outfall is submerged and when it is unsubmerged. The acute mixing zone has a dilution factor of 2.7. The acute mixing zone is also defined as the area within a circle of 36.0-m (118-ft)-ft radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface, during times when the outfall is submerged. The acute mixing zone for this discharge at times when the end of the pipe is not under water due to tidal fluctuations is defined as the area within a half-circle of 36.0-m (118-ft) radius, centered on the point where the effluent enters marine water. The acute dilution factor remains the same for conditions when the outfall is submerged and when it is exposed above the surface of the water.The WQC may be exceeded within the authorized mixing zones. All WQC will be met and apply at the boundary of the chronic mixing zone.

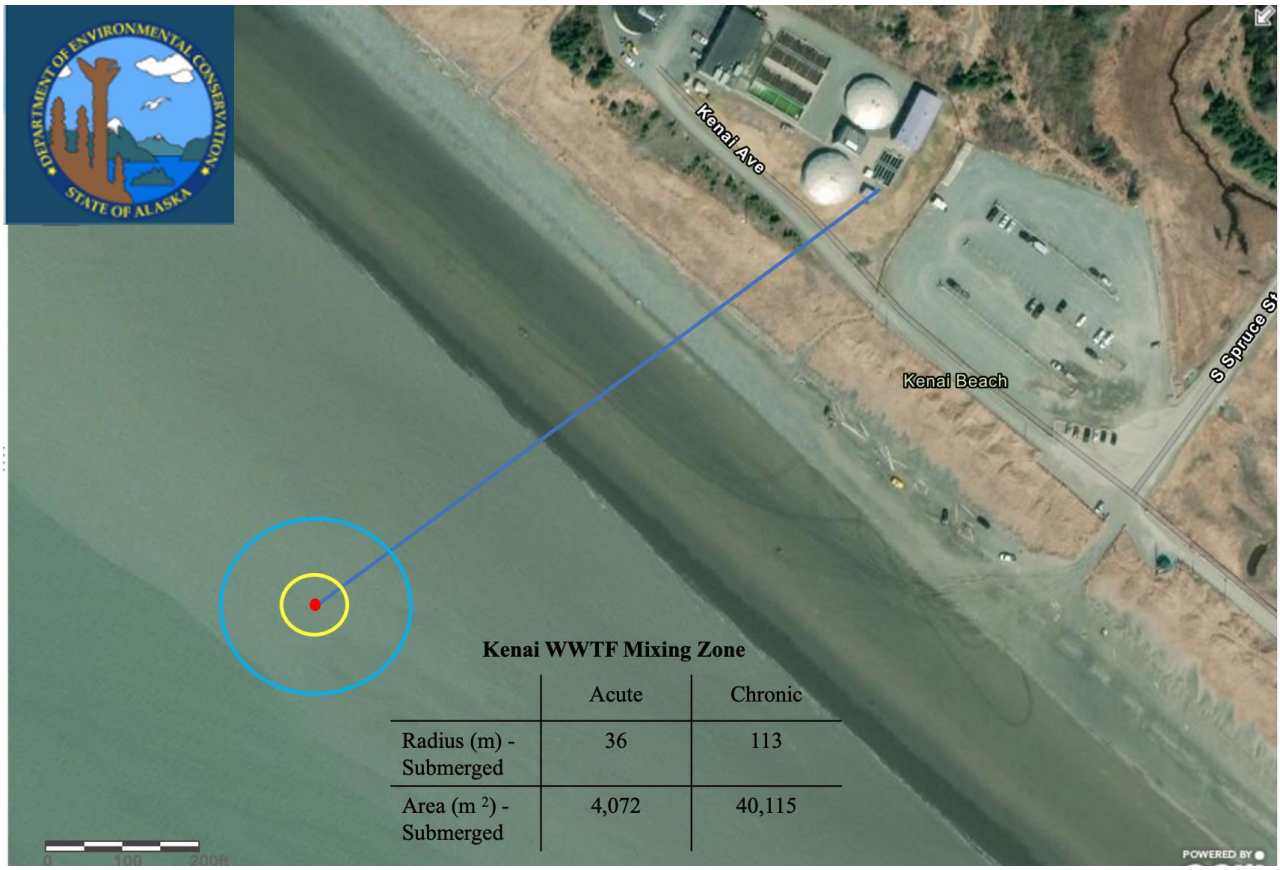
Table 7 shows the dilution factors and mixing zone dimensions used in the previous permit compared to the dilution factors and mixing zone dimensions for this permit.

Table 7: Mixing Zone Dilution Factors and Dimensions for the Permit

Mixing Zone	Previous Permit [2015]-[2020]				Current Permit [2021]-[2026]			
	DF	Radius length (m)	Shape	Area (m^2)	DF	Radius length (m)	Shape	Area (m^2)
Acute-submerged	6.7	7	Circle	154	2.7	36	Circle	4,072
Chronic-submerged	18	150	Circle	70,686	17.4	113	Circle	40,115
Acute-unsubmerged	6.7	7	Half-Circle	77	2.7	36	Half-Circle	2,036
Chronic-unsubmerged	18	150	Half-Circle	35,343	17.4	113	Half-Circle	20,058

Figure 4 shows a map view of the submerged chronic and acute mixing zones for the permit.

Figure 4: Kenai Wastewater Treatment Facility Submerged Chronic and Acute Mixing Zones



According to EPA (1991) and 18 AAC 70.240, lethality to passing organisms would not be expected if an organism passing through the plume along the path of maximum exposure is not exposed to concentrations exceeding the acute criteria when averaged over a one-hour time period. Furthermore, the travel time of an organism drifting through the acute mixing zone must be less than approximately 15 minutes if a one-hour exposure is not to exceed the acute criterion. DEC determined that the travel time of an organism drifting through the acute mixing zone to be approximately 4.6 minutes; therefore, there will be no lethality to organisms passing through the acute mixing zone.

Fact Sheet Appendix D outlines criteria that must be met in order for the Department to authorize a mixing zone. These criteria include the size of the mixing zone, treatment technology, and existing uses of the waterbody, human consumption, spawning areas, human health, aquatic life, and endangered species.

Table 8: Summary of CORMIX Inputs Used by DEC and SLR

CORMIX Input	DEC		SLR	
	Acute	Chronic	Acute	Chronic
Discharge Excess Concentration (%)	100	100	100	100
Effluent Flow Rate (mgd)	1.3	1.3	1.44	0.709
Effluent Density (kg/m^3)	999.637	999.637	999.637	999.637
Average Depth to Seafloor (m)	1.1; 0.13 unsubmerged	1.1; 0.13 unsubmerged	0.60; 0.13 unsubmerged	1.51
Depth at Discharge (m)	1.1;0.091 unsubmerged	1.1;0.091 unsubmerged	0.60;0.091 unsubmerged	1.51
Wind Speed (m/s)	3.8	3.8	3.8	3.8
Current Speed (m/s)	0.2 – 10th / 0.6 – 50th / 1.0 – 90th		0.2 – 10th	0.6 – 50th
Manning's n	0.02	0.02	0.02	0.02
Ambient water density (kg/m^3)	1017.19	1017.19	1017.13	1017.13
Position of Bank	Left	Left	Left	Left
Distance to Bank (m)	350	350	305	395
Vertical Angle σ (degrees)	90	90	90	90
Horizontal Angle θ	0	0	0	0
Channel Bottom Slope (degrees)	0.2 – only unsubmerged	0.2 – only unsubmerged	0.2 – only unsubmerged	NA [a]
Channel Depth (m)	0.091	0.091	0.091	NA
Channel Width (m)	1.64	1.64	1.64	NA
Port Diameter (m^2)	0.2431	0.2431	0.2431	0.2431
Port Height (m)	NA	NA	0.19	0.3048
Required Dilution Ammonia: $\frac{MEC-Cs}{WQC-Cs} x\ 100$ (%)	52.36	5.76	NA	4.33
Required Dilution Copper: $\frac{MEC-Cs}{WQC-Cs} x\ 100$ (%)	36.29	21.75	32.79	NA
WQ Standard Ammonia: $\frac{1}{Required\ Dilution}$	1.9	17.4	NA	23
WQ Standard Copper: $\frac{1}{Required\ Dilution}$	2.8	4.6	3.1	NA

Footnote:

a) NA = Not Analyzed

4.5.1 Size

In accordance with 18 AAC 70.240(k), the mixing zone must be as small as practicable. In order to ensure that the mixing zone is as small as practicable, DEC used CORMIX to model the chronic and acute mixing zones for

seasonal flow rates, effluent temperatures, effluent flow rates and ambient density profiles. 18 AAC 70.240(b)(2) requires the Department to consider the characteristics of the effluent after treatment of the wastewater. DEC reviewed the most recent five years of DMRs from August 2015 through October 2020, bench sheet data from June 2017 to November 2020, and the City's wastewater discharge application, Form 2A, to determine which parameters had RP to exceed WQ criteria at the end of pipe, and which of the parameters required the most dilution to meet WQ criteria for the chronic and acute mixing zones. Ammonia is the parameter that requires the most dilution to meet chronic WQ criteria in the chronic mixing zone and therefore is the driving parameter. Ammonia was modeled in CORMIX to determine the smallest practicable chronic mixing zone size. Copper required the most dilution in the acute mixing zone to meet acute WQ criteria. Copper was modeled in CORMIX to determine the smallest practicable acute mixing zone size.

The MECs for ammonia and copper were calculated in the RPA Tool. The Department followed the RPA Guide to calculate ambient concentrations of ammonia and copper. More information about calculations used to obtain ambient concentrations for copper and ammonia can be found in Part 3.3 and Appendix A.

In accordance with 18 AAC 70.240, the Department determined that the size of the mixing zone for the Kenai WWTF discharge is appropriate. In the permit, the chronic mixing zone size is defined as the area within a circle of 113-m (371-ft radius), centered on the end of the outfall pipe and extending from the marine bottom to the surface. The chronic mixing zone for this discharge at times when the end of the pipe is not under water due to tidal fluctuations is defined as the area within a half-circle of 113-m (371-ft) radius, centered on the point where the effluent enters marine water. The dilution factor for the chronic mixing zone in the permit is 17.4. The chronic mixing zone authorized for: ammonia, temperature, zinc, and WET. The chronic mixing zone size is driven by the dilution required for ammonia; the dilution factor for the chronic mixing zone is 17.4. The previous permit also identified ammonia as the driver for the chronic mixing zone and defined the chronic mixing zone as the area within a circle of 150-m (492-ft radius), centered on the end of the outfall pipe and extending from the marine bottom to the surface. The chronic mixing zone for this discharge was also at times when the end of the pipe was not under water due to tidal fluctuations and was defined as the area within a half-circle of 150-m (492-ft) radius, centered on the point where the effluent enters marine water. The dilution factor for the chronic mixing zone in the previous permit was 18. The decreased area and dilution factor of the chronic mixing zone size in the current permit is a result of new CORMIX modeling. In the current CORMIX model, effluent data for ammonia collected during the previous five years provided a new excess concentration value for ammonia and ambient monitoring conducted during the previous five years provided a new chronic ammonia criterion and ambient ammonia concentration. During the previous five years, the City has implemented improvements to the Kenai WWTF with the goal of reducing ammonia in the effluent according to the steps outlined in a compliance schedule in the previous permit. As a result of the facility improvements, ammonia levels were significantly reduced in mid-2017, compared to ammonia results reported earlier in the previous permitting period. Considering that the ammonia results reported after June 2017 were the result of permanent facility upgrades and operational improvments and not part of a normal effluent ammonia data results distribution, only ammonia results from July 2017 and later were used in the mixing zone modeling and development of ammonia WQBELs in the permit. More information about Kenai WWTF facility improvments according to the 2015 permit compliance schedule can be found in Part 2.4.1. More information about ammonia WQBELs can be found in Part 3.3 and Appendix A. The new CORMIX input data resulted in changes to the modeled radius length of the mixing zone and an overall decrease in the chronic mixing zone area compared to the previous permit.

The acute mixing zone is sized according to the dilution required by copper to meet acute aquatic life WQ criteria. The acute mixing zone is based on five years of copper effluent data submitted by the permittee and DMR results from the August 2015 to October 2020. The acute mixing zone surrounds the outfall and is contained within the larger chronic mixing zone, with copper as the driving parameter, for conditions when the outfall is submerged and when it is unsubmerged. The acute mixing zone has a dilution factor of 2.7. The acute mixing zone is also defined as the area within a circle of 36.0-m (118-ft)-ft radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface, during times when the outfall is submerged. The acute mixing zone for this discharge at times when the end of the pipe is not under water due to tidal fluctuations is defined as the area within a half-circle of 36.0-m (118-ft) radius, centered on the point where the effluent enters marine water. The acute dilution factor remains the same for conditions when the outfall is submerged and when it is exposed above the surface of the water. In the previous permit, copper was also the driving parameter.The CORMIX model indicates that water quality criteria would be met relatively rapidly through the acute mixing zone, approximately parallel to the direction of tidal flow, generally in a southeasterly direction. The mixing zone is sized to ensure: 1) the water quality criteria found in 18 AAC 70 are met at the boundary of the mixing zones, 2) the mixing zone is as small as practicable, and 3) compliance with all other applicable mixing zone regulations. The acute mixing zone for this discharge in the previous permit was defined as the area within a circle of seven-meter (23-ft) radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface. The acute mixing zone for this discharge at times when the end of the pipe was not under water due to tidal fluctuations, was defined as the area within a half circle of seven-meter (23-ft) radius, centered on the point where the effluent enters marine water. The acute mixing zone had a dilution factor of 6.7. The increased area of the mixing zone size in the current permit relative to the previous is a result of new CORMIX modeling and input data for copper, the parameter driving the acute mixing zone in the current permit. In the previous permit, due to high variablility of data and small dataset of copper results available, the MEC for copper was not used, as is the usual procedure according to the RPA Guide. Instead of a projected MEC value, the Maximum Observed Value (MOC) for copper was used in the CORMIX modeling for the previous permit; possibly providing a smaller acute mixing zone size than would have been modeled if there had been sufficient data to calculate an MEC for copper. The dilution factor in the previous permit was 6.7, more than twice the dilution factor of the previous permit. The new CORMIX input data resulted in changes to the modeled radius length of the mixing zone and an overall increase in the acute mixing zone area in the current permit as compared to the previous permit.

The relationship between dilution and factors and mixing zone sizes is predicted by CORMIX modeling. Per 18 AAC 83.135 (b)(2), the Department has cause to modify a permit when the Department receives new information that was not available at the time of permit issuance, and the new information would have justified the imposition of different permit conditions at the time of issuance.

4.5.2 Technology

In accordance with 18 AAC 70.240(c)(1), the Department finds that available evidence reasonably demonstrates that the wastewater at the Kenai WWTF will be treated to remove, reduce, and disperse pollutants using methods found by the Department to be the most effective and technological and economical feasible, consistent with the highest statutory and regulatory treatment requirements.

The Kenai WWTF wastewater treatment system includes removal of solids and grit followed by biological treatment in aeration basins, clarification and disinfection by chlorination. Wastewater operations at the WWTF generally exceed minimum treatment requirements. The Kenai WWTF achieved 94% average BOD_5 removal and 95% average TSS removal during the previous permitting period, exceeding the 85% removal requirement for both parameters.

4.5.3 Existing Use

In accordance with 18 AAC 70.240(c)(2) and (3) and 18 AAC 70.240(c)(4)(B) and (C), the mixing zone has been appropriately sized to fully protect the existing uses of Cook Inlet. Water quality criteria are developed to specifically protect the uses of the waterbody as a whole. Therefore, if the water quality criteria are met in the waterbody then the existing uses are protected. Given that water quality criteria will be met at, and beyond, the boundary of the chronic mixing zone, the designated and existing uses beyond the boundary of the chronic mixing zone will be maintained and fully protected under the terms of the permit as required in 18 AAC 70.240(c).

The permit reissuance application does not propose any changes that would result in a lower quality effluent. Effluent monitoring and receiving water monitoring have indicated that the discharge neither partially nor completely eliminates an existing use of the waterbody outside of the mixing zone...

Furthermore, the results of the most recent five years of WET testing have indicated that toxicity does not exist at levels that would be expected to result in any biological impairment of the waterbody or cause an environmental effect or damage to the ecosystem that the department considers so adverse that a mixing zone is not appropriate.

In DEC's analysis, ammonia required the most dilution of the parameters that demonstrated RP to exceed water quality criteria, and therefore determined the final chronic mixing zone size. Temperature, copper zinc, and WET fit within the chronic mixing zone sized for ammonia. The chronic ammonia mixing zone has a dilution factor of 17.4 and is defined as the area within a circle of 113-m (371-ft) radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface. The chronic mixing zone for this discharge at times when the end of the pipe is not under water due to tidal fluctuations is defined as the area within a half-circle of 113-m (371-ft) radius, centered on the point where the effluent enters marine water. The acute mixing zone, with copper as the driving factor, has a dilution factor of 2.7. The acute mixing zone is defined as the area within a circle of 36.0-m (118-ft) radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface, during times when the outfall is submerged. The acute mixing zone for this discharge at times when the end of the pipe is not under water due to tidal fluctuations is defined as the area within a half-circle of 36.0-m (118-ft) radius, centered on the point where the effluent enters marine water.The WQC may be exceeded within the authorized chronic mixing zones. All WQC will be met and apply at the boundary of the chronic mixing zone.

To ensure that existing uses for Cook Inlet are protected outside the chronic mixing zone, the City performs WET tests on a periodic basis. WET tests are laboratory tests that measure total toxic effect of an effluent on living organisms. WET tests use small vertebrate and invertebrate species and/or plants to measure the aggregate toxicity of an effluent and is included in the permit to demonstrate any potential toxicity resulting from the WWTF discharge.

During the previous permitting cycle, the City conducted twice-annual chronic toxicity tests for fertilization on either the test organisms *Strongylocentrotus purpuratus* (purple sea urchin) or *Dendraster excentricus* (sand dollar). The organisms were tested at the five following effluent concentrations: 11.2%, 8.5%, 5.6%, 2.8%, and 1.4% and a control (0% effluent). The results of the WET tests indicated that the toxic effects from the Kenai WWTF effluent did not exceed the chronic toxicity threshold (TUc = 18.0) that would have required additional WET testing, although the results from the July 2019 WET test on *Dendraster excentricus* showed that that the toxic effects for fertilization were close to the threshold limit at the highest effluent concentration. WET tests are required by the permit on the test organisms *Strongylocentrotus purpuratus* or *Dendraster excentricus* forfertilization. The WET tests will be conducted every year during the time period between May 1 and October 31 at the five following effluent concentrations: 23%, 11.5%, 5.7%, 2.9%, 1.4%, and a control (0%). The permit chronic toxicity trigger is 17.4.

4.5.4 Human Consumption

In accordance with the conditions of the permit, and in accordance with 18 AAC 70.240(d)(6) the pollutants discharged cannot produce objectionable color, taste, or odor in aquatic resources harvested for human consumption; nor can the discharge preclude or limit established processing activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting.

There is no indication that the pollutants discharged have produced objectionable color, taste, or odor in aquatic resources harvested for human consumption. Additionally, the discharge has not precluded or limited established processing activities or commercial, sport, personal use, or subsistence fish and shellfish harvesting. Signs are required to be posted to inform the public that certain activities such as harvesting of aquatic life for raw consumption and primary contact recreation should not take place in the mixing zone.

4.5.5 Spawning Areas

In accordance with 18 AAC 70.240(f), in lakes, streams, rivers, or other flowing fresh waters, a mixing zone will not be authorized in a spawning area for Arctic grayling northern pike lake trout, brook trout, sheefish, burbot, landlocked coho salmon, chinook salmon, sockeye salmon, or anadromous or resident rainbow trout, Arctic char, Dolly Varden, whitefish, or cutthroat trout.

The mixing zone is authorized in the marine waters of Cook Inlet. 18 AAC 70.240(f), which prohibits authorizing mixing zones in streams, rivers or other flowing fresh waters used for anadromous or resident fish spawning, does not apply. Discharges to fresh waters are not authorized under the permit.

The Alaska Department of Fish and Game (ADF&G) anadromous waters interactive catalog indicates that the outfall to Cook Inlet is located in relative proximity to, but not directly within, an area where fish are known to spawn. DEC contacted Megan Marie ADF&G on July 23, 2020 to inquire about Essential Fish Habitat in Cook Inlet, in the vicinity of the outfall, 60.5522 ° North latitude and 151.2777° West longitude. At Ms. Marie's suggestion, DEC requested information about whether this location presented any specific concerns regarding spawning areas or migration routes for anadromous fish from Brian Blossom, Kenai area manager for the Habitat Division, ADF&G, in an email sent on September 19, 2020 Mr. Blossom responded on September 30, 2020, with the comment that "ADF&G has reviewed proposed APDES permit renewal for the City of Kenai Wastewater Treatment Facility discharge into Cook Inlet and any potential spawning fish habitat near the outfall. We do not have any verified information or reports on spawning fish populations in the immediate vicinity of the outfall." Mr. Blossom attached a report, "*Juvenile Salmon Seasonal Abundance and Habitat Preference in Selected Reaches of the Kenai River, Alaska 1987 – 1988*", (October 1988) and referred DEC to. pages 17-21 of the report, stating that section included results on juvenile salmonid and other species of fish captured and recorded near the Kenai River delta.

4.5.6 Human Health

In accordance with 18 AAC 70.240(d)(1), the mixing zone will not result in pollutants discharged at levels that will bioaccumulate, bioconcentrate, or persist above natural levels in sediments, water, or biota to significantly adverse levels, based on consideration of bioaccumulation and bioconcentration factors, toxicity, and exposure. 18 AAC 70.240(d)(2) states that the mixing zone may not present an unacceptable risk to human health from carcinogenic, mutagenic, teratogenic, or other effects as determined using risk assessment methods approved by DEC and consistent with 18 AAC 70.025. An analysis of the effluent data that was included with the City's application for permit reissuance and the results of the RPA conducted on pollutants of concern indicated that the level of treatment is protective of human health. The effluent data was then used in conjunction with applicable WQC, which serve the purpose of protecting human and aquatic life, to size the mixing zone to ensure all WQC are met in the waterbody at the boundary of the mixing zone.

An analysis of the effluent testing data that was included with the Kenai WWTF wastewater discharge application and the results of the RPA conducted on pollutants of concern indicate that the level of treatment at the Kenai WWTF is protective of human health. The quality of the effluent is expected to meet water quality criteria in the receiving water. More information about pollutants of concern to human health in the Kenai WWTF effluent can be found in Appendix A.

4.5.7 Aquatic Life and Wildlife

In accordance with 18 AAC 70.240, pollutants for which the mixing zone will be authorized will not result in concentrations that result in undesirable or nuisance to aquatic life, cause permanent or irreparable displacement of indigenous organisms, or a reduction in fish or shellfish population levels. Nor will the discharge form a barrier to migration or prevent zone of passage in the receiving water.

Based on a review of effluent data (including WET testing results), outfall structure and location, mixing zone modeling, and river velocities at the point of discharge, the Department concludes that the discharge will meet all water quality criteria at the boundary of and outside the mixing zone. DEC determined that the mixing zones will not create a significant adverse effect to fish spawning or rearing, form a barrier to migratory species, fail to provide a zone of passage, result in undesirable or nuisance aquatic life, result in permanent or irreparable displacement of indigenous organism, or result in reduction in fish population levels and that 18 AAC 70.240 are met.

The ADF&G anadromous waters interactive catalog indicates that the outfall to Cook Inlet is located in relative proximity to, but not directly within, an area where fish are not known to spawn. ADF&G responded on September 20, 2020 with a response to an email request for any additional information or concerns related to the discharge from the Kenai WWTF. In his response to DEC on September 19, 2020, Mr. Brian Blossom of ADF&G did not indicate that ADF&G had any additional concerns regarding aquatic life and wildlife as a result of discharges from the Kenai WWTF.

DEC performed CORMIX modeling for ammonia, zinc, and copper. The mixing zone models produced by CORMIX indicate that the travel time of an organism drifting through the acute mixing zone to be approximately 4.6 minutes; therefore, there will be no lethality to organisms passing through the acute mixing zone. Furthermore, the chronic and acute mixing zones sizes predicted by CORMIX modeling demonstrate that WQS will be met at the boundaries of the mixing zones and the mixing zone sizes are as small as practicable. CORMIX models incorporated expected tidal velocities, effluent temperatures, effluent flow rates and ambient density profiles and including the most recent five years of effluent data to determine which parameters had RP to exceed WQ criteria at the end of pipe, and then which of the parameters required the most dilution to meet WQ criteria for the chronic and acute mixing zones. Ammonia is the pollutant that requires the most dilution to meet WQS at the boundary of the chronic mixing zone. Temperature, zinc, and copper, other parameters in the mixing zone, also fit within the chronic mixing zone to meet their respective water quality criteria. WET testing conducted within the previous permitting cycle also do not indicate there would be chronic toxicity effects outside of the mixing zone.

Based on a review of effluent data (including WET testing results), outfall structure and location, mixing zone modeling, and tidal velocities at the point of discharge, the Department concludes that the discharge will meet all water quality criteria at the boundary of and outside the mixing zone.

DEC determined that the mixing zones will not create a significant adverse effect to fish spawning or rearing, form a barrier to migratory species, fail to provide a zone of passage, result in undesirable or nuisance aquatic life, result in permanent or irreparable displacement of indigenous organism, or result in reduction in fish population levels.

4.5.8 Endangered Species

In accordance with 18 AAC 70.240(c)(4)(F), the mixing zone will not cause an adverse effect on threatened or endangered species.

DEC contacted Mr. Drew Crane of the United States Fish & Wildlife Service (USFWS) and Mr. Douglass Cooper of USFWS on July 23, 2020, with inquiries about whether USFWS had any concerns about a permitted discharge from the Kenai WWTF at 60.5222 ^{o} North latitude and 151.5777 ^{o} West longitude impacting threatened or endangered species. Mr. Cooper responded to DEC's inquiry on the same day, with the advice that DEC should consult (USFWS)'s Information for Planning and Consultation (IPaC) tool at the website, https://ecos.fws.gov/ipac/location/index and if DEC had further question after consulting the IPaC tool or had difficulty interpreting the results, he would be available for assistance. Mr. Crane did not respond to the inquiry. After consulting the IPaC tool, DEC determined that the location of the outfall and a circular chronic mixing zone with a radius of 113 m was outside of a USFWS proposed or final critical habitat area for threatened or endangered species.

DEC also contacted Ms. Jenna Malek of the National Oceanic and Atmospheric Administration (NOAA) on July 23, 2020, to inquire about whether a discharge from the outfall of the Kenai WWTF would impact any threatened or endangered species. Ms. Malek responded the same day; stating that the following species would potentially be impacted:

Cook Inlet beluga whale
Steller sea lion
Humpback whale (Mexico and Western North Pacific Distinct Population Segments)
Fin Whale

No detrimental effects to fauna in the area have been documented with previously authorized mixing zones for the facility, nor does the mixing zone appear to pose an undesirable nuisance to aquatic life. The RPA and CORMIX modeling resulted in an overall decrease in the area of the mixing zone. The reduction in area of the mixing zone reduces the possibility for any threatened or endangered species potentially in the area to come into contact with the treated wastewater.

Due to the reduced size and short residence time of pollutants in the mixing zone, DEC has concluded that the mixing zones are sized to not cause an adverse effect on threatened or endangered species in the vicinity of the discharge. DEC will provide a copy of the permit and fact sheet to NOAA and USFWS when it is publicly noticed. Any comments received from the agencies regarding endangered species will be considered prior to issuance of the permit.

5.0 ANTIBACKSLIDING

18 AAC 83.480 requires that "interim effluent limitations, standards, or conditions must be at least as stringent as the final effluent limitations, standards, or conditions in the previous permit, unless the circumstances on which the previous permit was based have materially and substantially changed since the permit was issued, and the change in circumstances would cause for permit modification or revocation and reissuance under 18 AAC 83.135." 18 AAC 83.480(c) also states that a permit may not be reissued "to contain an effluent limitation that is less stringent than required by effluent guidelines in effect at the time the permit is renewed or reissued."

Effluent limitations may be relaxed as allowed under 18 AAC 83.480, CWA §402(o) and CWA §303(d)(4). 18 AAC 83.480(b) allows relaxed limitations in renewed, reissued, or modified permits when there have been material and substantial alterations or additions to the permitted facility that justify the relaxation, or, if the Department determines that technical mistakes were made.

Permit monitoring requirements that changed since the previous permit are new monitoring requirements for DO and phosphorus and a changed frequency of enterococci monitoring.

The 2015 permit required monitoring of ammonia, copper, TRC, FC and enterococci bacteria, and zinc. The current permit continues monitoring requirements for these parameters and establishes 8.8 mg/L and 2 mg/L, respectively, for monthly average and daily maximum ammonia effluent limits. The permit also establishes 9.9 μg/L and 15 μg/L monthly average and daily maximum copper effluent limits.

The effluent limitations in this permit reissuance are consistent with 18 AAC 83.480. Therefore, the permit effluent limitations, standards, and conditions in AK0021377 are as stringent as in the previously issued permit. Accordingly, no further backsliding analysis is required for this permit reissuance.

6.0 ANTIDEGRADATION

Section 303(d)(4) of the CWA states that, for water bodies where the water quality meets or exceeds the level necessary to support the waterbody's designated uses, WQBELs may be revised as long as the revision is consistent with the State's Antidegradation policy. The State's Antidegradation policy is found in the 18 AAC 70 Water Quality Standards (WQS) regulations at 18 AAC 70.015. The Department's approach to implementing the Antidegradation policy is found in 18 AAC 70.016 *Antidegradation implementation methods for discharges authorized under the federal Clean Water Act*. Both the Antidegradation policy and the implementation methods are consistent with 40 CFR 131.12 and approved by EPA. This section analyzes and provides rationale for the Department's decisions in the permit issuance with respect to the Antidegradation policy and implementation methods.

Using the policy and corresponding implementation methods, the Department determines a Tier 1 or Tier 2 classification and protection level on a parameter by parameter basis. A Tier 3 protection level applies to a designated water. At this time, no Tier 3 waters have been designated in Alaska.

18 AAC 70.015(a)(1) states that the existing water uses and the level of water quality necessary to protect existing uses must be maintained and protected (Tier 1 protection level).

Cook Inlet is listed in Category 3 on DEC's most recent Integrated Report (Alaska's 2018 Integrated Report). Waters listed in Category 3 lack sufficient information for DEC to make an impairment or attainment determination. Accordingly, this antidegradation analysis conservatively assumes that the Tier 2 protection level applies to all parameters, consistent with 18 AAC 70.016(c)(1).

18 AAC 70.015(a)(2) states that if the quality of water exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality must be maintained and protected, unless the Department authorizes a reduction in water quality (Tier 2 protection level).

The Department may allow a reduction of water quality only after the specific analysis and requirements under 18 AAC 70.016(b)(5)(A-C), 18 AAC 70.016(c)(7)(A-F), and 18 AAC 70.016(d) are met. The Department's findings are as follows:

18 AAC 70.016(b)(5)

(A) *existing uses and the water quality necessary for protection of existing uses have been identified based on available evidence, including water quality and use related data, information submitted by the applicant, and water quality and use related data and information received during public comment;*

(B) *existing uses will be maintained and protected; and*

(C) *the discharge will not cause water quality to be lowered further where the department finds that the parameter already exceeds applicable criteria in 18 AAC 70.020(b), 18 AAC 70.030, or 18 AAC 70.236(b).*

The water quality criteria, upon which the permit effluent limits are based, serve the specific purpose of protecting the existing and designated uses of the receiving water. Per 18 AAC 70.020 and 18 AAC 70.050, all

marine waters are protected for all uses; therefore, the most stringent water quality criteria found in 18 AAC 70.020 and in the DEC Toxics Manual apply and were evaluated. This will ensure existing uses and the water quality necessary for protection of existing uses of the receiving waterbody are fully maintained and protected.

The permit places limits and conditions on the discharge of pollutants. The limits and conditions are established after comparing TBELs and WQBELs and applying the more restrictive of these limits. The WQ criteria, upon which the permit effluent limits are based, serve the specific purpose of protecting the existing and designated uses of the receiving water. WQBELs are set equal to the most stringent water quality criteria available for any of the protected water use classes.

Conventional pollutants of concern in domestic wastewater are BOD_5, TSS, and pH. Additional domestic wastewater pollutants are temperature, DO, ammonia, FC and enterococci bacteria, and WET. Additional domestic wastewater pollutants in the Kenai WWTF effluent are copper, zinc, and TRC. The permit includes numeric effluent limits or continued monitoring, addressing each of these pollutants of concern. The permit requires facilities to implement an O&M Plan to minimize the production of waste and the discharge of pollutants to waters of the U.S., to ensure that domestic wastewater facilities provide for the protection or attainment of existing and designated uses.

The Department concludes the terms and conditions of the permit will be adequate to fully protect and maintain the existing uses of the water and that the findings under 18 AAC 70.016(b)(5) are met.

18 AAC 70.016(c)(7)(A –F) *if, after review of available evidence, the department finds that the proposed discharge will lower water quality in the receiving water, the department will not authorize a discharge unless the department finds that*

> ***18 AAC 70.016(c)(7)(A)*** *the reduction of water quality meets the applicable criteria of 18 AAC 70.020(b), 18 AAC 70.030, or 18 AAC 70.236(b), unless allowed under 18 AAC 70.200, 18 AAC 70.210, or 18 AAC 70.240;*

As previously stated, Section 1.2.2 of the permit requires that the discharge shall not cause or contribute to a violation of the WQS at 18 AAC 70. WQBELs are set equal to the most stringent water quality criteria available under 18 AAC 70.020(b) for any of the protected water use classes. Because of the nature of the permitted discharges, other pollutants are not expected to be present in the discharges at levels that would cause, have the reasonable potential to cause, or contribute to an exceedance of any Alaska WQS.

Fact Sheet Part 4.5: Mixing Zone Analysis of the permit requires that the discharge shall not cause a violation of the WQS except if excursions are authorized in accordance with provisions in 18 AAC 70.200 – 70.240 (i.e., mixing zone, variance, etc.).

As a result of the Kenai WWTF reasonable potential to exceed water quality criteria for temperature, ammonia, zinc, and copper, and available assimilative capacity in the receiving water, a mixing zone is authorized in the wastewater discharge permit in accordance with 18 AAC 70.240. More information about the Kenai WWTF mixing zone can be found in Fact Sheet Part 4.5. The resulting effluent end-of-pipe limits and monitoring requirements in the permit that are listed in Table 3 protect water quality criteria, and therefore, will not violate the water quality criteria found at 18 AAC 70.020 beyond the boundary of the authorized mixing zone. A smaller acute mixing zone has been authorized in the permit, consistent with 18 AAC 70.240(d)(7), to ensure no lethality to passing organisms occurs. The area of the chronic mixing zone is decreased from the previous permit, but the area of the acute mixing zone is increased due to mixing zone modeling characterizations calculated with new data for effluent and ambient ammonia concentrations and effluent copper concentrations. Both the chronic and acute dilution factors have decreased, providing additional assurance that WQS will be met at the boundaries of the mixing zones. More information about the sizes of the chronic and acute mixing zones for the Kenai WWTF can be found in Fact Sheet Part 4.5.1. Even considering the changes in the chronic

and acute mixing zone sizes and dilution factors relative to the previous permit, DEC is assured that WQS will be met at the boundaries of the mixing zones.

The permit reissuance application does not propose any changes that would likely result in wastewater of lower quality to be discharged than has been discharged under the previously issued NPDES permits or the previous APDES permit for the Kenai WWTF. The Alaska WQS upon which the permit effluent limits are based, serve the specific purposes of protecting the existing and designated uses.

Based on the results of the RPA, there are WET requirements imposed by the permit. The permittee must conduct WET tests one time per year in the summer season (May 1 – October 31) to determine if the effluent is creating toxicity in the receiving water beyond the boundary of the authorized chronic mixing zone. If WET tests reveal that the discharge could have toxicity beyond the boundary of the chronic mixing zone, the permittee shall perform accelerated testing and identify the source of the toxicity. The permittee must notify DEC of the exceedance in writing within two weeks of receipt of test results. WET results from this permit issuance will be used when the permittee applies for reissuance of the permit to ensure the applicable criteria of 18 AAC 70.030 are met.

Site-specific criteria as allowed by 18 AAC 70.235 have not been established for Cook Inlet, as listed in 18 AAC 70.236(b), and are therefore not applicable. The permit does not authorize short term variance or zones of deposit under 18 AAC 70.200 or 18 AAC 70.210; therefore does not apply.

The Department has determined the reduction of water quality meets the applicable criteria of 18 AAC 70.020(b), 18 AAC 70.030, or 18 AAC 70.236(b), and that the finding is met.

18 AAC 70.016(c)(7)(B) *each requirement under (b)(5) of this section for a discharge to a Tier 1 water is met;*

See 18 AAC 70.016(b)(5) analysis and findings above.

18 AAC 70.016(c)(7)(C) *point source and state-regulated nonpoint source discharges to the receiving water will meet requirements under 18 AAC 70.015(a)(2)(D); to make this finding the department will (i) identify point sources and state-regulated nonpoint sources that discharge to, or otherwise impact, the receiving water;* and *(ii) consider whether there are outstanding noncompliance issues with point source permits or required state-regulated nonpoint source best management practices, consider whether receiving water quality has improved or degraded over time, and, if necessary and appropriate, take actions that will achieve the requirements of 18 AAC 70.015(a)(2)(D); and (iii) coordinate with other state or federal agencies as necessary to comply with (i) and (ii) of this subparagraph;*

The requirements under 18 AAC 70.015(a)(2)(D) state:

(D) all wastes and other substances discharged will be treated and controlled to achieve

(i) for new and existing point sources, the highest statutory and regulatory requirements; and

(ii) for nonpoint sources, all cost-effective and reasonable best management practices;

The highest statutory and regulatory requirements are defined at 18 AAC 70.015(d):

(d) For purposes of (a) of this section, the highest statutory and regulatory requirements are

(1) any federal technology-based effluent limitation identified in 40 C.F.R. 122.29 and 125.3, revised as of July 1, 2017 and adopted by reference;

(2) any minimum treatment standards identified in 18 AAC 72.050;

(3) any treatment requirements imposed under another state law that is more stringent than a requirement of this chapter; and

(4) any water quality-based effluent limitations established in accordance with 33 U.S.C. 1311(b)(1)(C) (Clean Water Act, sec. 301(b)(1)(C)).

The first part of the definition includes all federal technology-based effluent limit guidelines (ELGs) including "For POTWs, effluent limitations based upon…Secondary Treatment" at 40 CFR § 125.3(a)(1) defined at 40 CFR § 133.102, adopted by reference at 18 AAC 83.010(e). The ELGs set standards of performance for existing and new sources and are incorporated in the permit.

The second part of the definition references the minimum treatment standards for domestic wastewater discharges found at 18 AAC 72.050. The conditions of this permit require the permittee to meet or exceed the minimum treatment standards described in 18 AAC 72.050. Wastewater operations at the Kenai WWTF regularly exceed minimal percent removal and concentration based secondary treatment requirements for POTWs at 40 CFR § 133.102 and 18 AAC 72.050. The facility includes preliminary treatment of influent then aeration of the wastewater. After aeration, the wastewater is sent through a clarifying process, disinfected with chlorine and undergoes a dechlorination treatment prior to discharge through an outfall to Cook Inlet. This treatment achieves the highest statutory and regulatory requirements. The Department finds that this requirement is met.

The third part of the definition refers to treatment requirements imposed under another state law that are more stringent than 18 AAC 70. Other regulations beyond 18 AAC 70 that apply to this permitting action include 18 AAC 15 and 18 AAC 72. Neither the regulations in 18 AAC 15 and 18 AAC 72, nor another state law that the Department is aware of impose more stringent requirements than those found in 18 AAC 70.

The fourth part of the definition refers to WQBELS. WQBELs are designed to ensure that the WQS of a waterbody are met and may be more stringent than TBELs. Section 301(b)(1)(C) of the CWA requires the development of limits in permits necessary to meet WQS by July 1, 1977. WQBELs included in APDES permits are derived from EPA-approved 18 AAC 70 WQS. APDES regulation 18 AAC 83.435(a)(1) requires that permits include WQBELs that can "achieve water quality standard established under CWA §303, including state narrative criteria for water quality." The permit requires compliance with the 18 AAC 70 WQS, includes effluent limits for copper, ammonia, FC and enterococci bacteria and pH, and monitoring for other applicable WQS pollutants.

The Department reviewed available information on known point source discharges to receiving waters covered under the permit and found no outstanding noncompliance issues.

After review of the methods of treatment and control and the applicable statutory and regulatory requirements, including 18 AAC 70, 18 AAC 72, and 18 AAC 83, the Department finds that the discharge authorized under this general permit meets the highest applicable statutory and regulatory requirements; therefore, 18 AAC 70.016(c)(7)(C) finding is met.

18 AAC 70.016(c)(7)(D)(i-ii) *the alternatives analysis provided under (4)(C-F) of this subsection demonstrates that*

- *(i) a lowering of water quality under 18 AAC 70.015(a)(2)(A) is necessary; when one or more practicable alternatives that would prevent or lessen the degradation associated with the proposed discharge are identified, the department will select one of the alternatives for implementation; and*
- *(ii) the methods of pollution prevention, control, and treatment applied to all waste and other substances to be discharged are found by the department to be the most effective and practicable.*

The Department has determined that discharge under the limitations and requirements of the permit is identified as the only practicable alternative; therefore 18 AAC 70.016(c)(7)(D)(i) finding is met.

(i) The methods of prevention, control, and treatment the Department finds to be most effective and reasonable are currently in use at the facility and include meeting federal (40 CFR 133) and state (18 AAC 72.050) requirements. The Kenai WWTF utilizes a variety of measures to prevent, control and treat the pollution that may be generated as a result of the facility's wastewater treatment operations, as described in Fact Sheet Part 2. The facility O&M Plan establishes standard operational procedures and regular maintenance schedules for the prevention, control, and treatment of all wastes and other

substances discharged from the facility. The O&M Plan that prevents or minimizes the release of pollutants into Cook Inlet include minimum components such as preventative maintenance, spill prevention, water conservation, and public information and education. Section 2.6 of the permit requires that pollutants removed in the course of treatment such as screenings and grit be disposed of in accordance with Alaska Solid Waste Management Regulations at 18 AAC 60.

The Department has determined that the methods of pollution prevention, control, and treatment applied to all waste and other substances to be discharged are found by the department to be the most effective and practicable; therefore 18 AAC 70.016(c)(7)(D)(ii) finding is met.

18 AAC 70.016(c)(7)*(E) except if not required under (4)(F) of this subsection, the social or economic importance analysis provided under (4)(G) and (5) of this subsection demonstrates that a lowering of water quality accommodates important social or economic development under 18 AAC 70.015(a)(2)(A);*

The City of Kenai has been discharging wastewater to Cook Inlet under the NPDES Program since 1973 and under the APDES program since 2015. The facility currently serves an estimated population of 7,800. The community's entire sewer infrastructure has been constructed to drain to the community's treatment facility that discharges to Cook Inlet. Further, as previously mentioned, the Department has found that the facility routinely produces effluent quality far exceeding the secondary treatment requirement of 40 CFR Part 133, adopted by reference at 18 AAC 83.010. The facility's continued operation is important to the public health and the regional economy, as well as the overall economic and social development of the State of Alaska.

The Department has determined that the operation of the WWTF and the discharges authorized by the permit demonstrates that a lowering of water quality accommodates important social or economic development; therefore, 18 AAC 70.016(c)(7)(E) finding is met.

18 AAC 70.016(c)(7)(F) *18 AAC 70.015 and this section have been applied consistent with 33 U.S.C. 1326 (Clean Water Act, sec. 316) with regard to potential thermal discharge impairments.*

Discharges authorized under the permit are not associated with a potential thermal discharge impairment; therefore, the finding is not applicable.

7.0 OTHER PERMIT CONDITIONS

7.1 Quality Assurance Project Plan

The permittee is required to develop procedures to ensure that the monitoring data submitted are accurate and to explain data anomalies if they occur. The permittee is required to update, implement and/or maintain the QAPP. The QAPP shall consist of standard operating procedures the permittee must follow for collecting, handling, storing and shipping samples; laboratory analysis; precision and accuracy requirements; data reporting, including method detection/reporting limits; and quality assurance/quality control criteria. The permittee is required to amend the QAPP whenever any procedure addressed by the QAPP is modified. The plan shall be retained on site and made available to the Department upon request.

7.2 Operation and Maintenance Plan

The permit requires the permittee to properly operate and maintain all facilities and systems of treatment and control. Proper operation and maintenance is essential to meeting discharge limitations, monitoring requirements, and all other permit requirements at all times. The permittee is required to review and update the O&MP that was required under the previous permit within 120 days of the effective date of the final permit to ensure that it includes appropriate best management practices and pollution prevention measures. The plan shall be retained on site and made available to the Department upon request.

7.3 Industrial User Survey

18 AAC 83.340 requires POTWs to identify and locate all Significant Industrial Users (SIUs) that discharge process wastewaters and associated pollutants to their wastewater treatment system. General and specific pretreatment prohibitions at 40 CFR 403.5, adopted by reference at 18 AAC 83.010(g)(2), contain prohibitions that apply to each industrial user introducing pollutants into a POTW, whether or not the industrial user is subject to other National Pretreatment Standards, or any national, State, or local Pretreatment Requirements. Therefore, in order to assess whether an industry or business has the potential to violate any general or specific pretreatment prohibition, and to determine if a pretreatment program should be developed and/or if pretreatment requirements should be included in the Kenai WWTF wastewater discharge permit, the permittee is required to submit with their permit reissuance application, Form 2A, a list of those industries or businesses that discharge and/or have the potential to discharge non-domestic wastewater to the Kenai WWTF''s collection system. DEC may request further information on specific industries or business to assist in this evaluation.

7.4 Electronic Discharge Monitoring Report

The permittee must submit DMR data electronically through NetDMR per Phase I of the E-Reporting Rule (40 CFR 127) upon the effective date of the permit. Authorized persons may access permit information by logging into the NetDMR Portal (https://cdxnodengn.epa.gov/oeca-netdmr-web/action/login). DMRs submitted in compliance with the E-Reporting Rule are not required to be submitted as described in permit APPENDIX A – Standard Conditions unless requested or approved by the Department. Any DMR data required by the Permit that cannot be reported in a NetDMR field (e.g. mixing zone receiving water data, etc.), shall be included as an attachment to the NetDMR submittal. DEC has established an e-Reporting Information website at https://dec.alaska.gov/water/compliance/electronic-reporting-rule that contains general information about this new reporting format. Training materials and webinars for NetDMR can be found at https://netdmr.zendesk.com/home.

Phase II of the E-Reporting rule will integrate electronic reporting for all other reports required by the Permit (e.g., Annual Reports and Certifications) and implementation is expected to occur during the term of the permit. Permittees should monitor DEC's E-Reporting Information website (http://dec.alaska.gov/water/compliance/electronic-reporting-rule) for updates on Phase II of the E-Reporting Rule and will be notified when they must begin submitting all other reports electronically. Until such time, other reports required by the Permit may be submitted in accordance with permit APPENDIX A – Standard Conditions.

7.5 Standard Conditions

Appendix A of the permit contains standard regulatory language that must be included in all APDES permits. These requirements are based on the regulations and cannot be challenged in the context of an individual APDES permit action. The standard regulatory language covers requirements such as monitoring, recording, reporting requirements, compliance responsibilities, and other general requirements.

8.0 OTHER LEGAL REQUIREMENTS

8.1 Ocean Discharge Criteria Evaluation

Section 403(a) of the CWA, Ocean Discharge Criteria, prohibits the issuance of a permit under Section 402 of the CWA for a discharge into the territorial sea, the water of the contiguous zone, or the oceans except in compliance with Section 403. Permits for discharges seaward of the baseline of the territorial seas must comply with the requirements of Section 403, which include development of an Ocean Discharge Criteria Evaluation (ODCE).

Interactive nautical charts depicting Alaska's baseline plus additional boundary lines are available at https://www.charts.noaa.gov/ChartCatalog/Alaska.html and interactive maps at https://alaskafisheries.noaa.gov/mapping/arcgis/rest/services/NOAA_Baseline/MapServer.

The charts and maps are provided for information purposes only. The U.S. Baseline committee makes the official determinations on baseline. Ocean Discharge Criteria are not applicable for marine discharges to areas located landward of the baseline of the territorial sea.

A review of the baseline line maps revealed that the Kenai WWTF Outfall 001A terminus is positioned landward of the baseline of the territorial sea; therefore, Section 403 of the CWA does not apply to the permit, and an ODCE analysis is not required to be completed for this permit reissuance. Further, the permit requires compliance with WQS such that 40 CFR 125.122(b) is met and therefore the discharge is presumed not to cause unreasonable degradation of the marine environment.

8.2 Endangered Species Act

The National Marine Fisheries Service (NMFS) is responsible for administration of the Endangered Species Act (ESA) for listed cetaceans, seals, sea lions, sea turtles, anadromous fish, marine fish, marine plants, and corals. All other species (including polar bears, walrus, and sea otters) are administered by the United States Fish & Wildlife Service (USFWS).

The Endangered Species Act (ESA) requires federal agencies to consult with the National Oceanic and Atmospheric Administration (NOAA), NMFS and the USFWS if their actions could beneficially or adversely affect any threatened or endangered species. As a state agency, DEC is not required to consult with these federal agencies regarding permitting actions; however, DEC voluntarily contacted the agencies to notify them of the proposed permit issuance and to obtain listings of threatened and endangered species near the discharge.

DEC contacted USFWS and NOAA on July 23, 2020 and requested information about threatened or endangered species under their respective jurisdictions in the vicinity of the Kenai WWTF outfall.

On July 23, 2020, DEC received an e-mail message from Ms. Jenna Malek of NOAA, stating that the following endangered or threatened marine mammal species may be impacted by discharges from the Kenai WWTF outfall:

Cook Inlet beluga whale
Steller sea lion
Humpback whale (Mexico and Western North Pacific Distinct Population Segments)
Fin Whale

This fact sheet and the permit will be submitted to the agencies for review during the public notice period and any comments received from these agencies will be considered prior to issuance of the permit.

8.3 Essential Fish Habitat

Essential fish habitat (EFH) includes the waters and substrate (sediments, etc.) necessary for fish from commercially fished species to spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires federal agencies to consult with NOAA when a proposed discharge has the potential to adversely affect (reduce quality and/or quantity of) EFH.

DEC contacted Megan Marie of ADF&G on July 23, 2020 and requested they identify any concerns regarding Essential Fish Habitat or in the vicinity of the Kenai WWTF outfall. Ms. Marie responded to the inquiry with a statement that NOAA Fisheries would be responsible for determinations regarding essential fish habitat or federally designated or proposed critical habitat and that ADF&G does not have regulatory jurisdiction over fish habitat in marine waters. Ms. Marie also suggested contacting Brian Blossom, ADF&G Kenai area manager for the Habitat Division. DEC contacted Mr. Blossom on September 18, 2020, to inquire whether ADF&G had any particular concerns about the discharge from the Kenai WWTF and its potential impact on EFH. Mr. Blossom

responded in a September 19, 2020 email message and did not indicate in his communication that ADF&G had concerns about discharges from the Kenai WWTF outfall affecting EFH.
As a state agency, DEC is not required to consult with NOAA on EFH; however, DEC voluntarily contacts agencies to notify them of the proposed permit issuance and to obtain listings of EFH in the area. The Department accessed EFH information via use of NOAA's Habitat Conservation Interactive EFH Mapper located at: https://www.habitat.noaa.gov/protection/efh/efhmapper/ .The Data Query Tool was used for Cook Inlet, near the Kenai WWTF outfall location. This tool indicated that the Kenai WWTF outfall location and mixing zone area intersects with spatial data representing EFH for the following species/management units:

Chinook Salmon - Marine Immature Adult, Marine Mature Adult
Chum Salmon - Marine Immature Adult, Marine Mature Adult
Pink Salmon - Marine Mature Adult, Marine Juvenile
Sockeye Salmon - Marine Mature Adult, Marine Immature Adult, Marine Juvenile
Coho Salmon - Marine Mature Adult, Marine Juvenile

No Habitat Areas of Particular Concern (HAPC) nor EFH areas protected from fishing were identified at the location.

This fact sheet and the permit will be submitted to the agencies for review during the public notice period and any comments received from these agencies will be considered prior to issuance of the permit.

8.4 Sludge (Biosolids) Requirements

Sludge means any solid, semi-solid, or liquid residue removed during the treatment of municipal wastewater or domestic sewage. State and federal requirements regulate the management and disposal of sewage sludge (biosolids). The permittee must consult both state and federal regulations to ensure proper management of the biosolids and compliance with applicable requirements.

8.4.1 State Requirements

The Department separates wastewater and biosolids permitting. The permittee should contact the Department's Solid Waste Program for information regarding state regulations for biosolids. The permittee can access the Department's Solid Waste Program web page for more information and who to contact.

8.4.2 Federal Requirements

EPA is the permitting authority for the federal sewage sludge regulations at 40 CFR Part 503. Biosolids management and disposal activities are subject to the federal requirements in Part 503. The Part 503 regulations are self-implementing, which means that a permittee must comply with the regulations even if no federal biosolids permit has been issued for the facility.

A POTW is required to apply for an EPA biosolids permit. The permittee should ensure that a biosolids permit application has been submitted to EPA. In addition, the permittee is required to submit a biosolids permit application to EPA for the use or disposal of sewage sludge at least 180 days before this APDES permit expires in accordance with 40 CFR §§122.21(c)(2) and 122.21(q) [see also 18 AAC 83.110(c) and 18 AAC 83.310, respectively]. The application form is NPDES Form 2S and can be found on EPA's website, www.epa.gov , under NPDES forms. A completed NPDES Form 2S should be submitted to:

U.S. Environmental Protection Agency
Region 10, NPDES Permits Unit OWW-130
Attention: Biosolids Contact
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

The EPA Region 10 telephone number is 1-800-424-4372. Information about EPA's biosolids program and CWA Part 503 is available at www.epa.gov and either search for 'biosolids' or go to the EPA Region 10 website link and search for 'NPDES Permits'.

8.5 Permit Expiration

The permit will expire five years from the effective date of the permit.

9.0 REFERENCES

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Lisa Woolard (lisa@gvjones.com), "RE: Kenai WWTF", email message, June 8, 2020.

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Scott Curtin (scurtin@kenai.city), “RE: Information needed for Kenai WWTF permit reissuance”, email message, June 17, 2020.

Scott Curtin (scurtin@kenai.city), “Re: Information needed for Kenai WWTF permit reissuance”, email message, June 22, 2020.

Scott Curtin (scurtin@kenai.ciyt), “RE: Concern about in-house metals analyses being performed at the Kenai WWTF”, email message, July 27, 2020.

Scott Curtin (scurtin@kenai.city), æ Re: Final Report - 1204023 Zinc Copper Testing”, email message, August 18, 2020.

USEPA, “EPA Regions 8, 9 and 10 Toxicity Training Tool,” January 2010, pdf files located at: http://www.epa.gov/region8/water/wet/ToxTrainingTool10Jan2010.pdf

USEPA, “Technical Support Document for Water Quality-based Toxics Control,” EPA/505/2-90-001, USEPA Office of Water, Washington, DC, March 1991.

USEPA, “Water Quality Standards Handbook: Second Edition,” EPA-823-B-94-005a, USEPA, Washington, DC, August 1994.

USEPA, “Alaska DEC NPDES Permit Writer’s Course” Reference Manual. May, 2019.

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APPENDIX A- BASIS FOR EFFLUENT LIMITATIONS

The Clean Water Act (CWA) requires a Publicly Owned Treatment Works (POTWs) to meet effluent limits based on available wastewater treatment technology, specifically, secondary treatment effluent limit standards found at Title 40 Code of Federal Regulations (40 CFR) 133, adopted by reference in Alaska Administrative Code (AAC) 18 AAC 83.010(e). The Department may find, by analyzing the effect of an effluent discharge on the receiving waterbody, that secondary treatment effluent limits are not sufficiently stringent to meet Alaska water quality standards (WQS). In such cases, the Department is required to develop more stringent water quality-based effluent limits (WQBELs), which are designed to ensure that the WQS of the receiving waterbody are met.

Secondary treatment effluent limits for POTWs do not limit every pollutant that may be present in the effluent. Limits have only been developed for five-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), and pH. Effluent from a POTW may contain other pollutants, such as bacteria, ammonia, or metals, depending on the type of treatment system used and the quality of the influent to the POTW. When technology-based effluent limits (TBELs) do not exist for a particular pollutant expected to be present in the effluent, the Department must determine if the pollutant may cause or contribute to an exceedance of a water quality criteria (WQC) for the waterbody. If a pollutant causes or contributes to an exceedance of a WQC, a WQBEL for the pollutant must be established in the permit.

A.1 Secondary Treatment Effluent Limitations

The CWA requires a POTW to meet requirements based on available wastewater treatment technology. Section 301 of the CWA established a required performance level, referred to as "secondary treatment," that all POTWs were required to meet by July 1, 1977. The secondary treatment standards in 40 CFR §133.102, which the Department has adopted in 18 AAC 83.010(e), are TBELs that apply to all municipal wastewater treatment facilities and identify the minimum level of effluent quality attainable by application of secondary treatment in terms of BOD_5, TSS, and pH. In addition to the federal secondary treatment regulations in 40 CFR Part 133, the State of Alaska requires maximum daily limitations (MDLs) for BOD_5 and TSS in its own secondary treatment regulations (18 AAC 72.990(59)), listed in Table A-1.

Table A- 1: Secondary Treatment Effluent Limits

Parameter	Units	Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit	Average Monthly Minimum Removal
BOD_5	mg/L	30	45	60	85%
TSS	mg/L	30	45	60	
pH	S.U.	6.0 – 9.0 S.U. at all times			

A.2 Mass-Based Limitations

Per Alaska Pollutant Discharge Elimination Systems (APDES) regulations at 18 AAC 83.540 require that effluent limits be expressed in terms of mass unless they cannot appropriately be expressed by mass, if it is infeasible, or if the limits can be expressed in terms of other units of measurement. In addition, 18 AAC 83.520 requires that effluent limits for a POTW be calculated based on the design flow of the facility in million gallons per day (mgd). The facility design flow rate is 1.3 mgd. The Department used the design flow to calculate loading limits in the permit for BOD_5, TSS, total residual chlorine (TRC), ammonia as nitrogen (ammonia), total recoverable copper (copper), and total recoverable zinc (zinc). Expressing limitations in terms of concentration as well as mass encourages the proper operation of a

facility at all times. The mass-based limits are expressed in pounds per day (lbs/day) and are calculated as follows:

Mass based limit (lbs/day) = concentration limit (mg/L) × design flow (mgd) × 8.34

Where: 8.34 is a conversion factor with units (lbs x L) / (mg x gallon x 10^6)

A.3 Water Quality Based Effluent Limitations

A.3.1 Statutory and Regulatory Basis

18 AAC 70.010 prohibits conduct that causes or contributes to a violation of the WQS. 18 AAC 15.090 requires that permits include terms and conditions to ensure criteria are met, including operating, monitoring, and reporting requirements.

The regulations require the permitting authority to make this evaluation using procedures that account for existing controls on point and nonpoint sources of pollution, the variability of the pollutant in the effluent, species sensitivity (for toxicity), and where appropriate, dilution in the receiving waterbody. The limits must be stringent enough to ensure that WQS are met and must be consistent with any available wasteload allocation (WLA).

The CWA requires that the effluent limit for a pollutant be the more stringent of either TBELs or WQBELs. TBELs are established by the Environmental Protection Agency (EPA) for many industries in the form of Effluent Limitation Guidelines (ELGs), are based on available pollution control technology and are adopted by reference in 18 AAC 83. The Department adopts the subject ELGs by reference in 18 AAC 83.010.

A.3.2 Reasonable Potential Analysis

When evaluating the effluent to determine if WQBELs based on chemical-specific numeric criteria are needed, the Department projects the receiving waterbody concentration for each pollutant of concern downstream of where the effluent enters the receiving waterbody. The chemical-specific concentration of the effluent and receiving waterbody and, if appropriate, the dilution available from the receiving waterbody, are factors used to project the receiving waterbody concentration. If the projected concentration of the receiving waterbody exceeds the numeric criterion for a limited parameter, then there is a reasonable potential that the discharge may cause or contribute to an excursion above the applicable water quality standard, and a WQBEL must be developed.

According to 18 AAC 70.990(38), a mixing zone is an area in a waterbody surrounding, or downstream of, a discharge where the effluent plume is diluted by the receiving water within which specified water quality criteria may be exceeded. Water quality criteria and limits may be exceeded within a mixing zone. A mixing zone can be authorized only when adequate receiving waterbody flow exists, and the concentration of the pollutant of concern in the receiving waterbody is below the numeric criterion necessary to protect the designated uses of the waterbody.

Reasonable Potential Analysis (RPA) calculations were computed for the following parameters known to be present in the Kenai WWTF effluent: ammonia, copper, and zinc. Parameters were chosen for RPA through monitoring required by the previous permit, expanded effluent testing or other testing conducted by the permittee, the City of Kenai (City). The RPA was conducted in accordance with the Department's *APDES Permits Reasonable Potential Analysis and Effluent Limits Development Guide* (RPA Guide).

A.3.3 Procedure for Deriving Water Quality-Based Effluent Limits

The *Technical Support Document for Water Quality-Based Toxics Control* (TSD) (Environmental Protection Agency (EPA), 1991) and the AWQC recommend the flow conditions for use in calculating

WQBELs using steady-state modeling. The TSD, APDES Guide, and the WQS state the WQBELs intended to protect aquatic life uses should be based on the lowest seven-day average flow rate expected to occur once every ten years (7Q10) for chronic criteria and the lowest one-day average flow rate expected to occur once every ten years (1Q10) for acute criteria. In marine settings, tidal velocities must be representative of critical conditions as well.

18 AAC 70.020(b)(22)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife and 18 A The first step in developing a WQBEL is to develop a WLA for the pollutant. A WLA is the concentration or loading of a pollutant that the permittee may discharge without causing or contributing to an exceedance of the WQC or a total maximum daily load (TMDL) in the receiving waterbody. If a mixing zone is authorized in the permit, the WQC apply at all points outside the mixing zone.

In cases where a mixing zone is not authorized, either because the receiving waterbody already exceeds the criterion, the receiving waterbody flow, or for some other reason one is not authorized, the criterion becomes the WLA. Establishing the criterion as the WLA ensures that the permittee will not cause or contribute to an exceedance of the criterion. The WQS at 18 AAC 70.020(a) designates classes of water for beneficial uses of water supply, water recreation, and of growth and propagation of fish, shellfish, other aquatic life, and wildlife.

A.3.4 Specific Water Quality-Based Effluent Limits

A.3.4.1 pH

The WQS at 18 AAC 70.020(b)(18)(A)(i) Aquaculture and 18 AAC 70.020(b)(18)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife states that the pH water quality criteria for marine waters may not be less than 6.5 or greater than 8.5 Standard Units (S.U.).

DEC reviewed pH monitoring data for Outfall 001A from August 2015 to October 2020. During this time period the lowest minimum pH value recorded was 6.4 S.U. and the highest minimum pH value recorded was 7.60 S. U. The lowest pH maximum pH value recorded was 6.5 S.U. and the highest maximum pH value recorded was 7.9 S. U. The previous permit implemented WQBELs for pH that required a minimum of 6.5 S.U. and a maximum of 8.5 S.U., monitored at a frequency of two times per week. During the previous permitting period the minimum pH WQBEL was exceeded one time, in April 2020, and the maximum pH WQBEL was not exceeded. The WQBELs and monitoring frequency requirement is carried forward in the permit.

A.3.4.2 Temperature

The WQS at 18 AAC 70.020(b)(22)(A)(i) Aquaculture and
AC 70.020(b)(22)(D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life state that conditions may not cause the weekly average temperature to increase more than 1 ^{o} C. The maximum rate of change may not exceed 0.5 ^{o} C per hour. Normal daily temperature cycles may not be altered in amplitude or frequency.

The Department reviewed 60 effluent temperature results from Discharge Monitoring Reports (DMRs) submitted monthly for the Kenai WWTF from August 2015 – October 2020. Receiving water monitoring conducted quarterly from 2017- 2020 demonstrated that the 85th percentile for the ambient water temperature of Cook Inlet is 14.5 degrees Centigrade (^{o}C). The WQC maximum for Cook Inlet is calculated to be 15.5 ^{o}C; the accepted marine ambient temperature is 15 ^{o}C. Monitoring results from the previous permitting period demonstrate that the Kenai WWTF's effluent temperature exceeded the Water Quality Criterion (WQC) of 15 ^{o}C 29 times. The effluent temperature results ranged from a minimum of 10.9 °C to a maximum of 23.1 °C. The effluent has reasonable potential to violate the temperature WQS. Since the Kenai WWTF cannot be

reasonably expected to meet the WQS at 18 AAC 70.020(b)(22)(A)(i) and 18 AAC 70.020(b)(22)(C), a mixing zone is required for temperature and temperature is included in the chronic mixing zone sized for ammonia.

The previous permit required monitoring of temperature five times per week and for the permittee to report the daily maximum observed temperature each month. The monitoring and reporting requirement for temperature is carried forward in the permit.

A.3.4.3 Total Residual Chlorine (TRC)

The Kenai WWTF uses chlorine to disinfect wastewater prior to discharge. The WQS at 18 AAC 70.020(b)(23)(C) defines TRC concentrations for aquatic life for marine water, as the concentration of substances in water may not exceed the numeric criteria for aquatic life for marine water shown in the *Alaska Water Quality Criteria Manual for Toxic and other Deleterious Organic and Inorganic Substances* (Toxics Manual) which corresponds to a TRC chronic limit of 0.0075 mg/L, and the acute limit of 0.013 mg/L.

DEC reviewed TRC monitoring data for Outfall 001A from August 2015 to October 2020. During this time period the reported TRC value never exceeded the compliance concentration/minimum detection threshold level of <0.1 mg/L. Since all but one TRC value reported during the previous permitting period were below the minimum detection level (MDL) of 0.10 mg/L, DEC did not have enough data to conduct an RPA on TRC values collected during the previous permitting period. DEC determined that TRC does not have RP to exceed WQC at the end of the pipe. DEC believes that the use of the MDL as an analytical chemistry performance standard provides an unambiguous and rational means to demonstrate that the best chemistry available at the time of permit issuance is being used.

The previous permit implemented WQBELs for TRC that required an average monthly concentration of 0.0075 mg/L and a daily maximum concentration of 0.013 mg/L, which correspond to the respective chronic and acute WQS at 18 AAC 70.020(b)(23)(C) for TRC. TRC was monitored at a frequency of six times per week in the previous permit. The facility uses a process of dichlorination to remove TRC before the effluent is discharged and this process makes it unlikely that TRC exceeds WQS at the end of the pipe. The WQBELs and monitoring frequency requirement for TRC are carried forward in the permit.

A.3.4.4 Fecal Coliform (FC) Bacteria

Fecal coliform bacteria are a non-pathogenic indicator species whose presence suggests the likelihood that pathogenic bacteria are present.

The WQS at 18 AAC 70.020(b)(14)(D) Harvesting of raw mollusk or other aquatic life criterion states that the fecal coliform (FC) bacteria concentration shall not exceed 14 fecal coliform colonies per 100 milliliters (FC/100 mL) and not more than 10% of samples shall exceed a FC bacteria concentration of 43 FC/100 mL.

DEC reviewed FC bacteria monitoring data for Outfall 001A from August 2015 to October 2020. The results of the daily maximum FC bacteria count ranged from 1 FC/100 mL to 43 FC/100 mL. The results of the average monthly FC bacteria count ranged from 1 FC/100 mL to 13.45 FC/100 mL. The previous permit limits of an average monthly limit (AML) of 14 FC/100 mL and a daily maximum limit (DML) of 43 FC/100mL were never exceeded.

FC bacteria cannot be reasonably expected to exceed WQ criteria at the end of the pipe. Based on the facility's consistent ability to produce an effluent capable of meeting the FC bacteria concentration limits, and compliance with the State's definition of disinfection at 18 AAC 72.990(21(A)(B), the FC bacteria limits and monitoring frequency requirements of once per week are carried forward from the previous permit.

A.3.4.5 Enterococci Bacteria

Enterococci bacteria are indicator organisms of harmful pathogens recommended by the EPA to protect primary contact recreation for marine waters.

The EPA Beaches Environmental Assessment and Coastal Health Act (BEACH Act) requires states and territories with coastal recreation waters to adopt enterococci bacteria criteria into their WQS. The WQS at 18 AAC 70.020(b)(14)(B) for contact recreation specifies that the enterococci bacteria monthly geomean concentration shall not exceed 35 enterococci colony forming units per 100 milliliters (cfu/100 mL) and not more than 10% of the samples may exceed a concentration of 130 enterococci cfu/100mL. Contact recreation is defined as activities in which there is direct and intimate contact with water. These activities would only take place during the summer season, May to September.

DEC reviewed enterococci bacteria monitoring data for Outfall 001A from August 2015 to October 2020. The daily maximum enterococci results ranged from 1 cfu/100 mL to 192 cfu/100 mL. The 130 cfu/100 mL criterion at 18 AAC 70.020(b)(14)(B) for contact recreation of was exceeded three times, twice (May and June 2018) during the summer season, May 1 – September 30, when the recreational standard applies. The average monthly geomean enterococci results ranged from 1 cfu/100 mL to 60.06 cfu/100 mL. The 35 cfu/100 mL criterion at 18 AAC 70.020(b)(14)(B) for contact recreation of was exceeded six times and twice (May 2018 and August 2019) during the summer season, May 1 – September 30 when the recreational contact use standard applies. The facility has stated that enterococci bacteria may require more attention to disinfection practices than are necessary to control FC bacteria and that it would be possible to control enterococci levels through operational controls to ensure that WQS for enterococci would be met at the end of the pipe.

It is reasonable to conclude that enterococci bacteria can be expected to meet WQ criteria in 18 AAC 70.020(b)(14)(B) for contact recreation at the end of the pipe, based on the facility's consistent ability to produce an effluent capable of meeting the FC bacteria concentration limits and compliance with the State's definition of disinfection at 18 AAC 72.990(21(A)(B).

The monitoring frequency of once-weekly sampling is changed from the previous permit to once-monthly sampling, consistent with permitting requirements for other wastewater treatment facilities and the time period for enterococci bacteria sampling is changed from year-round to sampling during the summer season only. The summer season for enterococci bacteria sampling is May 1 – September 30, determined to be when the receiving water would most likely be used for contact recreation. Enterococci bacteria monitoring is required to be performed at the same time as FC bacteria monitoring and shall be collected on the same day.

A.3.4.6 Total Ammonia (as Nitrogen)

Total ammonia is the sum of ionized (NH4+) and un-ionized ammonia (NH3). Temperature, pH, and salinity affect which form, NH4+ or NH3 is present. NH3 is more toxic to aquatic organisms than NH4+ and predominates with higher temperature and pH. Biological wastewater treatment processes reduce the amount of total nitrogen in domestic wastewater; however, without advanced treatment, wastewater effluent may still contain elevated levels of ammonia as nitrogen. Excess ammonia as nitrogen in the environment can lead to dissolved oxygen depletion, eutrophication, and toxicity to aquatic organisms.

In the previous APDES permit, ammonia was the parameter that required the greatest dilution to meet WQ criteria at the boundary of the chronic mixing zone and the permit conditions required the City to monitor ammonia in the effluent. Salinity, pH and temperature are physical properties used to determine ammonia water quality criteria; required as inputs to mixing zone modeling programs such as CORMIX, in addition to the inputs for ambient and effluent ammonia concentrations. The City collected receiving water ammonia

data between 2015 and 2020 and DEC derived ammonia criteria from the Toxics Manual, consistent with the Department's RPA Guide. The salinity, and 85th percentile of the pH and temperature receiving water data collected by City was used to extrapolate the ammonia criteria from tables contained in Appendix F and G of the Toxics Manual. An acute ammonia WQS numeric criterion of 10.5 mg/L and a chronic criterion of 1.6 mg/L were used for the RPA calculation of the critical ambient concentration (Cs) of 0.499 mg/L. More information about ammonia criteria derived from ambient water monitoring results can be found in Fact Sheet Part 4.5. The City also collected effluent monitoring data for Outfall 001A from August 2015 to November 2020. The previous permit imposed a compliance schedule with interim ammonia limits of 38 mg/L for the DML and 34 mg/L for the AML, to be in effect until 2025 or when the requirements of the compliance schedule were completed. The final ammonia limits, to be imposed after the compliance schedule was completed, were 29 mg/L for the DML and 14 mg/L for the AML. DEC used bench sheet data from June 2017 to November 2020 provided by the City to evaluate ammonia levels in effluent data. Results of ammonia concentrations in effluent data prior to July 2017 were not considered in DEC's RPA, because facility improvements to reduce ammonia to fulfill the compliance schedule undertaken beginning late in 2016 had been largely completed by mid-2017. For more information about facility upgrades undertaken to fulfill the compliance schedule requirements from the 2015 permit, see Part 2.4.1. Starting in mid-2017, ammonia levels in the effluent had been consistently reduced and results from testing prior to that time were not relevant to mixing zone analyses predicting future levels of ammonia in the effluent. The DML results between July 2017 and November 2020 ranged from 0.2 mg/L to 14.8 mg/L. The AML ranged from 0.1 mg/L to 7.5 mg/L. The interim ammonia limits were not exceeded during the previous permitting period for either DML or AML. Since April 2017, the DML has not exceeded 14 mg/L and the AML has not exceeded 10 mg/L; the thresholds required by the final ammonia limits.

DEC conducted RPA on the available ammonia effluent data and determined that there is RP for ammonia to exceed water quality criteria. The ammonia effluent data was incorporated into the CORMIX models.

The CORMIX mixing zone modeling program was used to determine that ammonia was the parameter that required the most dilution to meet WQS and was, therefore, the driver of the size of the chronic mixing zone. Since the current permit includes different data than that used to model mixing zone sizes in the previous permit, the mixing zone size for the current permit changed from the previous mixing zone size. The chronic mixing zone size in the current permit is reduced from the previous permit. The previous permit chronic mixing zone dimensions were defined as the area within a circle of 150-meter radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface. The chronic mixing zone for the discharge at times when the end of the pipe was not under water due to tidal fluctuations, was defined as the area within a half-circle of 150-meter radius, centered on the point where the effluent enters marine water. In the current permit, the chronic mixing zone with ammonia as the driving parameter is defined as the area within a circle of 113-m (371-ft radius), centered on the end of the outfall pipe and extending from the marine bottom to the surface. The chronic mixing zone for this discharge at times when the end of the pipe is not under water due to tidal fluctuations is defined as the area within a half-circle of 113-m (371-ft) radius, centered on the point where the effluent enters marine water. More information about mixing zone sizes can be found in Fact Sheet Part 4.5.1.

All other parameters fit within the mixing zone sized for ammonia. The permit implements new WQBELs for ammonia in the permit at Outfall 001A with a DML of 27 mg/L and an AML of 8.8 mg/L. More information about calculations for ammonia effluent limits in the permit can be found in Fact Sheet Appendix B. The selected limits are protective of WQ criteria at the boundary of the mixing zone. The monitoring frequency of monthly reporting is carried forward from the previous permit.

A.3.4.7 Copper

The WQS at 18 AAC 70.020(b)(23)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife state that the concentration of substances in water may not exceed the numeric criteria for aquatic life for marine water and human health for consumption of aquatic organisms only shown in the Toxics Manual, or any chronic and acute criteria established in this chapter, for a toxic pollutant of concern, to protect sensitive and biologically important life stages of resident species of this state. No ambient water monitoring for copper had been required in the previous permit. In order to determine the ambient concentration for copper (Cs) and in accordance with the RPA Guide, DEC determined Cs for copper to be 0.560 micrograms per liter (µg/L). This value is 15% of the most stringent copper WQS numeric criterion, 3.7 µg/L, the chronic aquatic life criterion.

Copper was identified as a pollutant of concern in the previous permit and was the driver of the acute mixing zone. WQBELs for copper were required in the permit; the DML for copper was 18 µg/L, the Average Weekly Limit (AWL) for copper was 27 µg/L and the AML was 36 µg/L with quarterly monitoring requirements for Outfall 001A.

DEC reviewed copper monitoring data results for Outfall 001A from August 2015 to November 2020, including results reported in DMRs and in expanded effluent testing results. The results ranged from 3.7 µg/L to 12.2 µg/L. In accordance with the RPA Guide, DEC determined that there is RP for copper to exceed water quality criteria at the end of the pipe and that copper was a parameter to be included in the mixing zone.

The CORMIX mixing zone modeling program was used to determine that copper was the parameter that required the most dilution to meet WQS at the boundary of the acute mixing zone and is the driver of the size of the acute mixing zone. The acute mixing zone is defined as the area within a circle of 36.0-m (118-ft)-ft radius, centered on the end of the outfall pipe and extending from the marine bottom to the surface, during times when the outfall is submerged. The acute mixing zone for this discharge at times when the end of the pipe is not under water due to tidal fluctuations is defined as the area within a half-circle of 36.0-m (118-ft) radius, centered on the point where the effluent enters marine water. More information about the size of the acute mixing zone can be found in Fact Sheet Part 4.5.1 and calculations for copper effluent limits in the permit can be found in Fact Sheet Appendix B.

The permit implements WQBELs for copper at Outfall 002A with a DML of 15 µg/L and an AML of 9.9 µg/L. The quarterly monitoring frequency requirement is carried forward from the previous permit. This is a new WQBEL in the permit and the selected limits are protective of WQ criteria at the boundary of the mixing zone.

A.3.4.8 Zinc

The WQS at 18 AAC 70.020(b)(23)(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife state that the concentration of substances in water may not exceed the numeric criteria for aquatic life for marine water and human health for consumption of aquatic organisms only shown in the Toxics Manual, or any chronic and acute criteria established in this chapter, for a toxic pollutant of concern, to protect sensitive and biologically important life stages of resident species of this state. No ambient water monitoring for zinc was required in the previous permit. In accordance with the RPA Guide, DEC determined Cs for zinc to be 12.9 µg/L. This value is 15% of the most stringent WQS numeric criterion, 86.1 µg/L, the chronic aquatic life criterion for zinc.

Zinc was identified as a pollutant of concern in the previous permit but no WQBELs for zinc were required. DEC reviewed zinc monitoring data from 17 quarterly monitoring results for Outfall 001A from August 2015 to November 2020, including results from expanded effluent testing events. The results ranged from

7.0 μg/L to 110.0 μg/L. In accordance with the RPA Guide, DEC determined that there is RP for zinc to exceed water quality criteria at the end of the pipe and was a parameter to be included in the mixing zone. WQBELs for zinc were not require in the permit, because even though zinc exceeded WQS at the end of the pipe, mixing zone models for zinc at the 10^{th}, 50^{th}, and 90^{th} percentiles of current speed indicated that zinc would meet WQS within a few meters of the discharge point.

The permit does not implement WQBELs for zinc at Outfall 001A, but the reporting and quarterly monitoring frequency requirements are carried forward..

A.3.4.9 Residues: Floating solids, debris, sludge, deposits, foam, scum, or other residues.

The Alaska WQS (2003) for residues are narrative. The most stringent standard for marine water, found at 18 AAC 70.020(b)(20)(C), "May not, alone or in combination with other substances or wastes, make the water unfit or unsafe for the use, or cause acute or chronic problem levels as determined by bioassay or other appropriate methods. May not, alone or in combination with other substances, cause a film, sheen, or discoloration on the surface of the water or adjoining shorelines; cause leaching of toxic or deleterious substances; or cause a sludge, solid, or emulsion to be deposited beneath or upon the surface of the water, within the water column, on the bottom, or upon adjoining shorelines." This narrative standard is carried forward from the previous permit.

A.4 Selection of the Most Stringent Limitations

Table A-2 provides a summary and reference for parameters that have effluent limits at Outfall 001A at Kenai WWTF.

Table A- 2: Summary of Effluent Limits

Parameter	Fact Sheet Reference	Type of Effluent Limit
BOD_5	Fact Sheet Part 3.3 Appendix A.1	TBEL (including minimum percentage removal) implemented at end of pipe
TSS		
pH	Fact Sheet Part 3.3 Appendix A.3.4.1	TBEL implemented at end of pipe
Temperature	Fact Sheet Part 3.3 Appendix A.3.4.2	WQBEL equal to 18 AAC 70 WQS implemented at boundary of chronic mixing zone
Total Residual Chlorine	Fact Sheet Part 3.3 Appendix A.3.4.3	WQBEL equal to 18 AAC 70 WQS implemented at end of pipe
Fecal Coliform Bacteria	Fact Sheet Part 3.3 Appendix A.3.4.4	WQBEL equal to 18 AAC 70 WQS implemented at end of pipe
Enterococci Bacteria	Fact Sheet Part 3.3 Appendix A.3.4.5	WQBEL equal to 18 AAC 70 WQS implemented at end of pipe
Total Ammonia, as Nitrogen	Fact Sheet Part 3.3 Fact Sheet Part 4.6 Appendix A.3.4.7	WQBEL equal to 18 AAC 70 WQS implemented at end of pipe, dilution from mixing zone applied to meet WQS at boundary of chronic mixing zone.
Copper (total recoverable)	Fact Sheet Part 3.3 Fact Sheet Part 4.5	WQBEL equal to 18 AAC 70 WQS implemented at end of pipe, dilution from mixing zone applied to meet WQS at boundary of

	Appendix A.3.4.7	chronic mixing zone.
Zinc (total recoverable)	Fact Sheet Part 3.3 Fact Sheet Part 4.5 Appendix A.3.4.8	WQBEL equal to 18 AAC 70 WQS implemented at end of pipe, dilution from mixing zone applied to meet WQS at boundary of chronic mixing zone.

APPENDIX B- REASONABLE POTENTIAL DETERMINATION

The following describes the process the Alaska Department of Environmental Conservation (the Department or DEC) used to determine if the discharge authorized in the draft permit has the reasonable potential to cause or contribute to a violation of Alaska Water Quality Standards (WQS). The Department used the process described in the *Technical Support Document* (TSD) *for Water Quality-Based Toxics Control* (Environmental Protection Agency, 1991) and DEC's guidance, *Alaska Pollutant Discharge Elimination System Permits Reasonable Potential Analysis and Effluent Limits Development Guide* (June 30, 2014) (RPA Guide) to determine the reasonable potential for any pollutant to exceed a water quality numeric criterion.

To determine if there is reasonable potential for the discharge to cause or contribute to an exceedance of water quality criteria for a given pollutant, the Department compares the maximum projected receiving waterbody concentration to the criteria for that pollutant. Reasonable potential to exceed exists if the projected receiving waterbody concentration exceeds water quality criteria, and a water quality-based effluent limit (WQBEL) must be included in the permit (18 Alaska Administrative Code 83.435).

The ambient concentration in the mass balance equation is based on a reasonable worst-case estimate of the pollutant concentration upstream from the discharge. For criteria that are expressed as maxima, the 85th percentile of the ambient data is generally used as an estimate of the worst case. If ambient data is not available, DEC uses 15% of the most stringent given pollutant's criteria as a worst-case example. Ammonia is used as an example to demonstrate the reasonable potential determination process.

B.1 Mass Balance

For a discharge to a flowing waterbody, the maximum projected receiving waterbody concentration is determined using a steady state model represented by the following mass balance equation:

$$C_d Q_d = C_e Q_e + C_u Q_u \qquad \text{(Equation B-1)}$$

Where,

C_d = Receiving waterbody concentration downstream of the effluent discharge

C_e = Maximum projected effluent concentration

C_u = Assumed receiving waterbody ambient concentration

Q_d = Receiving waterbody flow rate = $Q_e + Q_u$

Q_e = Effluent flow rate (set equal to the design flow of the wastewater treatment facility (WWTF)

Q_u = Receiving waterbody flow rate

When the mass balance equation is solved for C_d, it becomes:

$$C_d = \frac{C_e Q_e + C_u Q_u}{Q_e + Q_u} \qquad \text{(Equation B-2)}$$

The above form of the equation is based on the assumption that the discharge is rapidly and completely mixed with the receiving waterbody. If a mixing zone based on a percentage of the critical flow in the receiving waterbody is authorized based on the assumption of incomplete mixing with the receiving waterbody, the equation becomes:

$$C_d = \frac{C_e Q_e + C_u (Q_U \times MZ)}{Q_e + (Q_u \times MZ)} \qquad \text{(Equation B-3)}$$

Where, MZ = the fraction of the receiving waterbody flow available for dilution.

Where mixing is rapid and complete, MZ is equal to 1 and equation C-2 is equal to equation C-3 (i.e., all of the critical low flow volume is available for mixing). If a mixing zone is not authorized, dilution is not considered when projecting the receiving waterbody concentration, and

$$C_d = C_e \qquad \text{(Equation B-4)}$$

In other words, if a mixing zone is not authorized, the Department considers only the concentration of the pollutant in the effluent regardless of the upstream flow and concentration. If the concentration of the pollutant in the effluent is less than the WQS numeric criteria, the discharge cannot cause or contribute to a water quality

violation for that pollutant. In this case, the mixing or dilution factor (% MZ) is equal to zero and the mass balance equation is simplified to $C_d = C_e$.
Equation C-2 can be simplified by introducing a dilution factor (D):

$$D = \frac{Q_e + Q_u}{Q_e}$$ (Equation B-5)

After the D simplification, this becomes:

$$C_d = \frac{(C_e - C_u)}{D} + C_u$$ (Equation B-6)

B.2 Maximum Projected Effluent Concentration

To calculate the maximum projected effluent concentration, the Department used the procedure described in section 3.3 of the TSD, "*Determining the Need for Permit Limits with Effluent Monitoring Data*" and the process described in section 2.4 of DEC's RPA Guide. In this procedure, the 99th percentile of the effluent data is the maximum projected effluent concentration which is used in the calculation of the maximum projected receiving waterbody concentration.
Since there are a limited number of data points available, the 99th percentile is calculated by multiplying the maximum observed effluent concentration (MOC) by a reasonable potential multiplier (RPM). The RPM is the ratio of the 99th percentile concentration to the MOC and accounts for the statistical uncertainty in the effluent data. The RPM is calculated from the coefficient of variation (CV) of the data and the number of data points. The CV is defined as the ratio of the standard deviation of the data set to the mean. When fewer than 10 data points are available, the TSD and DEC's RPA Guide recommends making the assumption that the CV is equal to 0.6. A CV value of 0.6 is a conservative estimate that assumes a relatively high variability.

In the example of ammonia, the Department used ProUCL, a statistical software program, to determine a CV of 2.1985 for ammonia. ProUCL indicated that the data set follows a lognormal statistical distribution. Therefore, the RPM equation in section 2.4.2.1 of the RPA Guide is used to determine the RPM for ammonia.

$$RPM = \frac{\mu_n + z_{99}\,\sigma}{\mu_n + p_n\,\sigma}$$ (Equation B-7)

Where,
z_{99} = the z − statistic at the 99th percentile = 2.326
μ_n = mean calculated by ProUCL = NA
σ = the standard deviation calculated by ProUCL = 1.328
p_n = the z − statistic at the 95th percent confidence level of $(1 - 0.95)^{\frac{1}{n}} = 0.983$
n = number of valid data samples = 172
RPM = 1.3
The maximum expected concentration (MEC) is determined by multiplying the MOC by the RPM:

$$\text{MEC} = (\text{RPM})(\text{MOC})$$ (Equation B-8)

MOC = 14.8 milligrams per liter (mg/L)
In the case of ammonia,
MEC = (1.3)(14.8) = 19.62 mg/L

In the example of copper, the Department used ProUCL to determine a CV of 0.2869. ProUCL indicated that the data set follows a normal statistical distribution.

$$RPM = \frac{\mu_n + z_{99}\,\sigma}{\mu_n + p_n\,\sigma}$$ *(Equation B-7)*

Where,
z_{99} = the z − statistic at the 99th percentile = 2.326
μ_n = mean calculated by ProUCL = 7.958
σ = the standard deviation calculated by ProUCL = 2.283
p_n = the z − statistic at the 95th percent confidence level of $(1 - 0.95)^{\frac{1}{n}} = 0.891$
n = number of valid data samples = 26
RPM = 1.2
The maximum expected concentration (MEC) is determined by multiplying the MOC by the RPM:

$$MEC = (RPM)(MOC) \quad \text{(Equation B-8)}$$

MOC = 12.2 micrograms per liter (μg/L)
In the case of copper,
MEC = (1.2)(12.2) = 15.03 μg/L

Comparison with ammonia water quality criteria
In order to determine if RP exists for this discharge to exceed water quality criteria, the highest projected concentration is compared with the most stringent water quality criteria.
MEC = 19.62 mg/L > 1.6 mg/L (most stringent ammonia criterion)
YES, there is RP for ammonia to violate water quality criteria
Since there is RP for the effluent to cause an exceedance of water quality criteria for protection of aquatic life, and because ammonia is the parameter requiring the most dilution of pollutants that demonstrate reasonable potential to exceed water quality criteria, a WQBEL for ammonia is required. See Appendix C for that calculation.

Comparison with copper water quality criteria
In order to determine if RP exists for this discharge to exceed water quality criteria, the highest projected concentration is compared with the most stringent water quality criteria.
MEC = 15.03 μg/L > 3.7 μg/L (most stringent copper criterion; the acute aquatic life criterion)
YES, there is RP for ammonia to violate water quality criteria
Since there is RP for the effluent to cause an exceedance of water quality criteria for protection of aquatic life, and because copper is the parameter requiring the most dilution of pollutants that demonstrate reasonable potential to exceed the acute aquatic life water quality criterion, a WQBEL for copper is required. See Appendix C for that calculation.

Table B-1 summarizes the data, multipliers, and criteria used to determine reasonable potential to exceed water quality criteria. For each parameter, the MEC equals the maximum observed effluent concentration times the RPM producing a number based on wastewater treatment facility performance, which was used to determine if there is a reasonable potential for the effluent to exceed WQS.

Table B- 1: Reasonable Potential Determination at the End of Pipe

Parameter	Max Observed Effluent Conc.	Number of Samples	Coefficient of Variation (CV)	Reasonable Potential Multiplier (RPM)	Max Expected Effluent Conc. (MEC)[a]	Most Stringent Water Quality Criterion	Reasonable Potential (yes or no)
Ammonia as Nitrogen (mg/L)	14.8	172	2.1985	1.3	19.62	1.6	yes
Copper, total recoverable (µg/L)	12.2	26	0.2869	1.2	15.03	3.7	yes
Zinc, total recoverable (µg/L)	110.0	25	0.5234	1.4	149.28	86.1	yes

APPENDIX C- SELECTION OF EFFLUENT LIMITS

If the Alaska Department of Environmental Conservation (the Department or DEC) does not authorize a mixing zone, water quality standards (WQS) numeric criteria are applied at the end of the pipe, and technology-based effluent limits (TBELs) are selected for those parameters that are solely technology based.

When DEC authorizes a mixing zone, parameters are identified in the mixing zone that will require dilution to meet WQS numeric criteria. If there are TBELs for an identified parameter in the mixing zone, TBELs apply at the end of the pipe, and WQS numeric criteria for that parameter, apply at the boundary of the mixing zone. If the reasonable potential analysis (RPA) requires the development of water-quality based effluent limits (WQBELs) for specific parameters in order to protect human health criteria at the boundary of the mixing zone, WQBELs are applied as end-of-pipe effluent limits. Those parameters that are not identified in the authorized mixing zone, must meet applicable water quality numeric criteria at the end of pipe. In the absence of water quality criteria for a particular pollutant, such as for 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS), TBELs are applied as end-of pipe effluent limits.

In the case of the Kenai Wastewater Treatment Facility (Kenai WWTF, or the facility), ammonia demonstrated reasonable potential to exceed at the end of pipe and required the most dilution to meet water quality criteria at the boundary of the authorized chronic mixing zone. Copper demonstrated reasonable potential to exceed at the end of pipe and required the most dilution to meet water quality criteria at the boundary of the authorized acute mixing zone; therefore, the Department developed WQBELs for ammonia and copper.

C.1 Effluent Limit Calculation

Once the Department determines that the effluent has a reasonable potential to exceed a WQS, a WQBEL for the pollutant is developed. The Department used the process described in the *Technical Support Document* (TSD) *for Water Quality-Based Toxics Control* (Environmental Protection Agency, 1991) and DEC's guidance, *Alaska Pollutant Discharge Elimination System RPA and Effluent Limits Development Guide* (June 30, 2014) (RPA Guide) to calculate WQBELs for ammonia. The first step in calculating WQBELs is the development of a wasteload allocation (WLA) for the pollutant.

C.2 Mixing Zone-based WLA

When the Department authorizes a mixing zone for the discharge, the WLA is calculated using the available dilution, background concentrations of the pollutant, and the WQS. For the aquatic life chronic monthly limit, the WLA is applied directly as an average monthly limit (AML). The daily maximum limit (DML) is then calculated from the AML by applying a multiplier.

C.3 "End-of-Pipe" WLAs

In many cases, there is no dilution available, either because the receiving waterbody exceeds the criteria or because the Department does not authorize a mixing zone for a particular pollutant. When there is no dilution available, the criterion becomes the WLA. Establishing the criterion as the WLA ensures that the permittee's discharge does not contribute to an exceedance of the criterion. When a chronic aquatic life criterion applies to a pollutant, the chronic dilution factor is used to calculate a WLA.

C.4 Permit Limit Derivation

The Department applies the statistical approach described in Chapter 5 of the TSD to calculate the daily maximum limit (DML) and average monthly limit (AML). This approach takes into account effluent variability (using the coefficient of variation (CV)) and sampling frequency.

The DML is based on the CV of the data and the probability basis, while the AML is dependent on these two variables and the monitoring frequency. As recommended in the TSD, the Department used a probability basis of 95% for the AML calculation and 99% for the DML calculation.

The following is a summary of the steps to derive WQBELs from WQS numeric criteria for pollutants that have reasonable potential to exceed water quality numeric criteria. These steps are found in the RPA Guide and the guidance's accompanying Microsoft Excel RPA Tool. The guidance and tool were used to calculate the DMLs and AMLs for ammonia and copper in the Kenai WWTF permit. Ammonia and copper are illustrated below as examples.

Step 1- Determine the WLA

The first step in developing a WQBEL is to develop a wasteload allocation (WLA) for the pollutant. A WLA is the concentration or loading of a pollutant that the permittee may discharge without causing or contributing to an exceedance of water quality criteria or a total maximum daily load in the receiving waterbody.

In cases where a mixing zone is not authorized, either because the receiving waterbody already exceeds the criterion, the receiving waterbody flow is too low to provide dilution, or for some other reason one is not authorized, the criterion becomes the WLA. Establishing the criterion as the WLA ensures that the permittee will not cause or contribute to an exceedance of the criterion.

The acute and chronic aquatic life criteria are converted to WLAs using the following equation:

$$WLA_{a,c,hh} = (WQC_{a,c,hh})(D_{a,c,hh}) + C_s(1 - D_{a,c,hh})$$

$$WLA_{a,c,hh} = WQC_{a,c,hh}\left(\frac{Q_d + Q_s}{Q_d}\right) + C_s\left(1 - \left[\frac{Q_d + Q_s}{Q_d}\right]\right)$$

Where: $D_{a,c} = Dilution = \frac{(Q_d + Q_s)}{Q_d}$

D_{hh} = (Dilution [Human Health]) = D_c (Dilution[Chronic Aquatic Life])

Q_d = Critical Discharge Flow

C_s = Critical Upstream Concentration

$WLA_{a,c}$ = Wasteload Allocation (acute, ammonia)

$WQC_{a,c}$ = C_r = Water Quality Criterion(acute, chronic)

For ammonia,

D_a = not applicable

D_c = 17.4

C_s = 0.499 milligrams per liter (mg/L)

WLA_c = 19.13 mg/L

WQC_c = 1.6 mg/L

For copper,

D_a = 2.7

D_c = not applicable

$C_s = 0.56$ micrograms per liter (µg/L)

$WLA_a = 14.66$ µg/L

$WQA_a = 5.8$ µg/L

Step 2 - Determine the Long-Term Average (LTA)

The WLAs are converted to LTAs using multipliers that are derived from equations in section 5.4 of the TSD:

$$LTA_a = WLA_a * \exp(0.5\sigma^2 - z_{99}\sigma)$$

$$LTA_c = WLA_c * \exp(0.5\sigma_4^2 - z_{99}\sigma_4)$$

Where:

$z_{99} =$ the z − statistic at the 99^{th} percentile $= 2.326$

LTA_a only: $\sigma = \ln[CV^2 + 1]^{1/2}$

LTA_a only: $\sigma^2 = \ln[CV^2 + 1]$

LTA_c only: $\sigma_4 = \ln\left[\left(\frac{CV^2}{4}\right) + 1\right]^{1/2}$

LTA_c only: $\sigma_4^2 = \ln\left[\left(\frac{CV^2}{4}\right) + 1\right]$

$CV =$ coefficient ofvariation

For ammonia:

$LTA_a =$ not applicable

$LTA_c = 3.59$ mg/L

For copper:

$LTA_a = 7.93$ µg/L

$LTA_c =$ not applicable

Step 3 – Choosing the More Limiting LTA

To protect a waterbody from both acute and chronic effects, the more limiting of the two LTAs is used to derive the effluent limits. In the case of ammonia, the LTA_c is more limiting. In the case of copper, the LTA_a is more limiting.

Step 4 - Calculate the Permit Limits

The DML and AML are calculated using the following equations that are found in Table 5-2 of the TSD:

$$DML_{aquatic\ life} = LTA * exp(z_{99}\sigma - 0.5\sigma^2)$$

Where:

$z_{99} =$ the z − statistic at the 99^{th} percentile $= 2.326$

$\sigma_n = \ln[CV^2 + 1]^{1/2}$

$\sigma_n^2 = \ln[CV^2 + 1]$

$CV =$ coefficient of variation

$$AML_{aquatic\ life} = LTA * exp(z_{95}\sigma_n - 0.5\sigma_n^2)$$

Where:

$z_{95} =$ the $z-$ statistic at the 95^{th}percentile $= 1.645$

$$\sigma_n = \ln\left[\left(\frac{CV^2}{n}\right) + 1\right]^{1/2}$$

$$\sigma_n^2 = \ln\left[\left(\frac{CV^2}{n}\right) + 1\right]$$

$CV =$ coefficient of variation

$n =$ number of samples per month

For ammonia:

$DML = 27$ mg/L

$AML = 8.8$ mg/L

For copper:

$DML = 15$ µg/L

$AML = 9.9$ µg/L

APPENDIX D- MIXING ZONE ANALYSIS CHECKLIST

The purpose of the Mixing Zone Checklist is to guide the permit writer through the mixing zone regulatory requirements to determine if all the mixing zone criteria at 18 AAC 70.240 are satisfied, as well as provide justification to authorize a mixing zone in an Alaska Pollutant Discharge Elimination System permit. See Fact Sheet Section 4.5 for the Kenai Wastewater Treatment Facility mixing zone analysis.

	Description	Resources	Regulation
Size	Is the mixing zone as small as practicable? **Yes** **If yes, mixing zone may be approved as proposed or authorized with conditions.**	Technical Support Document for Water Quality-Based Toxics Control DEC's Reasonable Potential Analysis Guidance Environmental Protection Agency's Permit Writers' Manual CORMIX 11.0	**18 AAC 70.240(k)**
Technology	Were the most effective technological and economical methods used to disperse, treat, remove, and reduce pollutants? **Yes** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(c)(1)**
Low Flow Design	**For streams, rivers or other flowing fresh waters.** - Determine low flow calculations or documentation for the applicable parameters.	N/A	**18 AAC 70.240(l))**
Existing Uses	Does the mixing zone… (1) maintain and protect designated and existing uses of the waterbody as a whole? **Yes** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(c)(2)**

	Description	Resources	Regulation
	(2) impair overall biological integrity of the waterbody? **No** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(c)(3)**
	(3) create a public health hazard that would preclude or limit existing uses of the waterbody for water supply or contact recreation? **No** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(c)(4)(B)**
	(4) preclude or limit established processing activities or established commercial, sport, personal use, or subsistence fish and shellfish harvesting? **No** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(c)(4)(C)**
Human Consumption	Does the mixing zone… (1) produce objectionable color, taste, or odor in aquatic resources harvested for human consumption? **No** **If yes, mixing zone may not be approved.**		**18 AAC 70.240(d)(6)**
Spawning Areas	Does the mixing zone… (1) discharge in a spawning area for anadromous fish or Arctic grayling, northern pike, rainbow trout, lake trout, brook trout, cutthroat trout, whitefish, sheefish, Arctic char (Dolly Varden), burbot, and landlocked coho, chinook, and sockeye salmon? **No** **If yes, mixing zone may not be approved.**		**18 AAC 70.240(f)**

	Description	Resources	Regulation
Human Health	Does the mixing zone… (1) contain bioaccumulating, bioconcentrating, or persistent chemicals above natural levels to significantly adverse levels? **No** **If yes, mixing zone may not be approved.**		**18 AAC 70.240(d)(1)**
	2) contain chemicals expected to present a unacceptable risk to human health from carcinogenic, mutagenic, teratogenic, or other effects as determined using risk assessment methods approved by the Department? **No** **If yes, mixing zone may not be approved.**		**18 AAC 70.240(d)(2)**
	(3) occur in a location where the department determines that a public health hazard reasonably could be expected? **No** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(k)(4)**
Aquatic Life	Does the mixing zone… (1) cause a toxic effect in the water column, sediments, or biota outside the boundaries of the mixing zone? **No** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(c)(4)(A)**
	(2) result in a reduction in fish or shellfish population levels? **No** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(c)(4)(D)**
	(3) result in permanent or irreparable displacement of indigenous organisms? **No** **If yes, mixing zone may be approved as proposed or authorized with conditions**		**18 AC 70.240(c)(4)(E)**

	Description	Resources	Regulation
	(4) form a barrier to migratory species or fish passage? **No** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(c)(4)(G)**
	(5) result in undesirable or nuisance aquatic life? **No** **If yes, mixing zone may not be approved.**		**18 AAC 70.240(d)(5)**
	(6) prevent lethality to passing organisms; or exceed acute aquatic life criteria at and beyond the boundaries of a smaller initial mixing zone surrounding the outfall, the size of which shall be determined using methods approved by the Department? **Yes** **If no, mixing zone may not be approved.**		**18 AAC 70.240(d)(7)** **18 AAC 70.240(d)(8)**
Endangered Species	Are there threatened or endangered species (T/E spp) at the location of the mixing zone? If yes, are there likely to be adverse effects to T/E spp based on comments received from the United States Fish and Wildlife Service or National Oceanic and Atmospheric Association? If yes, will conservation measures be included in the permit to avoid adverse effects? **Cook Inlet beluga whale** **Steller sea lion** **Humpback whale (Mexico and Western North Pacific Distinct Population Segments)** **Fin Whale** **Cook Inlet Beluga whale** **could be in the vicinity. Services provided Draft Permit and Fact Sheet** **If yes, mixing zone may be approved as proposed or authorized with conditions.**		**18 AAC 70.240(c)(4)(F)**